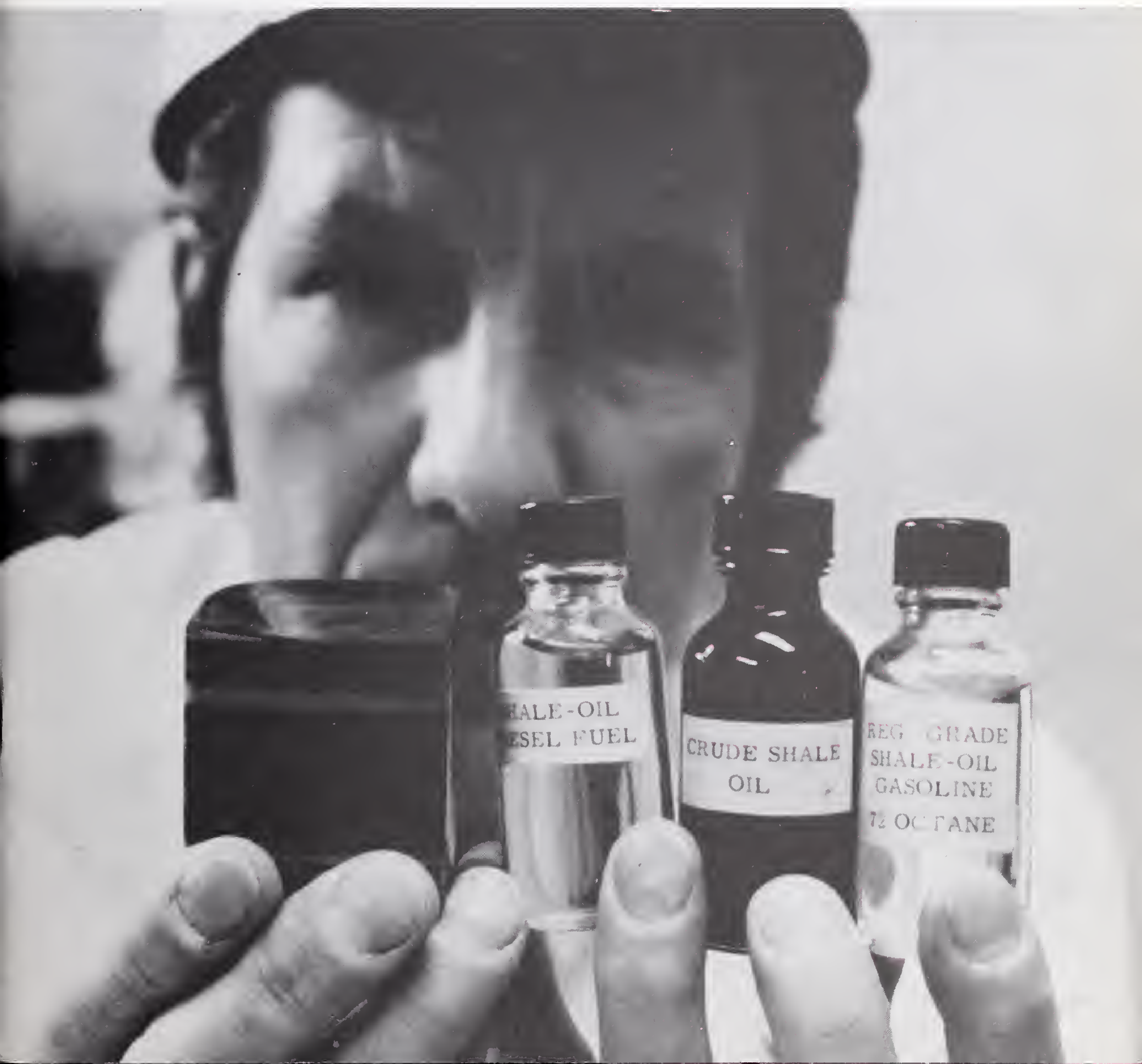
DFSC FUEL LINE

August 1979



Brigadier General Lawrence R. Seamon, USMC, Assumes Command

Brigadier General Lawrence R. Seamon, USMC, was designated Commander of the Defense Fuel Supply Center effective June 1, 1979. He has been Director of Materiel, Headquarters,U.S. Marine Corps, since July 1977.

A Marine since 1951, General Seamon has had a number of key supply and logistics assignments. He served as Assistant Force Supply Officer, Headquarters, Fleet Marine Force, Pacific; Division Supply Officer, 1st Marine Division; and Commanding Officer of the 3d Force Service Support Group.

General Seamon fought in Korea with the 1st Marine Division and received three awards of the Purple Heart Medal for wounds received in combat. He also holds the Bronze Star Medal with Combat "V", the Air Medal, and the Navy Commendation Medal with Combat "V".

Born in New York City, General Seamon is a graduate of the University of Bridgeport, Connecticut, with a bachelor's degree in psychology.

General and Mrs. Seamon and their son, Lawrence, live in Alexandria, Virginia.■

COMMANDER
DEFENSE FUEL SUPPLY CENTER
CAMERON STATION
ALEXANDRIA, VA. 22314

Two months ago, I took up my duties as Commander of the Defense Fuel Supply Center. I fully appreciated the awesome challenge of providing effective petroleum logistic support to our Armed Forces around the world. I also knew that I could accomplish my mission only with the support of a dedicated, professional staff, the Military Services, and a responsive petroleum industry.

My initial perceptions remain unchanged today. We at DFSC have a tremendous tasking, and we are methodically moving ahead to carry out that responsibility. I look forward enthusiastically to the months ahead and will continue to promote a positive and productive relationship with every organization and firm doing business with DFSC.

L. R. Seamon

L. R. SEAMON
Brigadier General, USMC
Commander

Record attendance at the Conference filled the DLA auditorium.

Worldwide Petroleum Conference

Maria Warno
Directorate of Supply Operations

The Defense Fuel Supply Center hosted the Fourth Annual Worldwide Petroleum Conference at Cameron Station from June 12 through June 14, 1979.

Attracting an audience of over 200 from all sectors of the fuels community, it was the largest conference ever. Participants included representatives from industry, the Department of Energy, General Services Administration, the Postal Service, Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics), Joint Chiefs of Staff, the Unified Commands, the Military Services, various elements of Headquarters, Defense Logistics Agency, and the Defense Fuel Supply Center.

Topics on the agenda ranged from discussions of the various phases of logistics to regulations established to control the environment. The major emphasis was on the current fuel shortage and how to deal with it. The second day of the conference was devoted to the problem area workshops: EUCOM, PACOM, LANTCOM/SOCOM: and CONUS. The workshops have always been popular with the conferees because they serve as a forum for participants to exchange views and receive spontaneous feedback on new ideas. This year was no exception.

The attendees were welcomed to the Conference by the DFSC Commander, Brigadier General Lawrence R. Seamon, who attended the entire conference. This enabled the newly assigned Commander to become acquainted with members of the fuels family worldwide and gave the conferees a opportunity to meet him.

The conference was productive; and, considering current events--most timely.■

DFSC Views the World Petroleum Market

Captain O. W. Hamilton, Jr., SC, USN
Deputy Commander
Defense Fuel Supply Center

The Defense Fuel Supply Center (DFSC) is finding its resourcefulness taxed in the current, turbulent, world petroleum market. DFSC has the mission of procuring and distributing fuel used by the armed forces and certain Federal agencies. With petroleum in increasing demand on the world market and prices escalating, the Center is encountering more and more challenges in meeting requirements.

During the period between the Arab Embargo of late 1973 and the Iranian situation of late 1978, both the long-term contract, or term market, and the spot market were very stable. Crude oil was readily available, and in Europe, refining capacity was overabundant. There were even several periods during which the crude oil supply on world markets was significantly in excess of demand.

Spot prices and term prices are generally very close during so-called normal periods. During these periods of supply and demand balance, contract customers enjoy a more reliable source of supply than do spot customers, while the latter are often able to obtain some price advantage for accepting the risk of less secure supplies.

Besides serving as an important marginal source of supply, the spot market serves as a leading indicator of things to come in the larger and more important term market, because market changes show up first in the spot market indicators. The situation in Iran in late 1978 led initially to dramatic changes in spot market indicators in Europe and other major petroleum markets. OPEC recognized the impact of the shutdown of Iranian supply on the spot markets, and in effect they altered the term markets by their joint actions in December 1978, and in March and June 1979.

After almost five years of relative stability, the Rotterdam spot market for kero jet fuel increased from about $0.40 to more that $1.20 per gallon in just a few months.

In effect, the crude oil market went from one extreme to the other between March 1978 and March 1979. First, the crude oil glut of 1977 and the first half of 1978 evaporated as buyers stockpiled oil for the anticipated January 1979 OPEC price hike. Then with the market in a normal pre-OPEC meeting status, the situation in Iran grew progressively more critical. As a result of the October general strike, Iranian production dropped some 500,000 bbls per day from September levels. In November, exports were completely halted. By the end of November, production had resumed to some extent, but it averaged about 2,000,000 bbls per day less than October. December 26, 1978 was the beginning of a total

cutoff of Iranian exports--a cutoff which did not end until early March 1979.

The impact on the first-quarter 1979 oil market of a cutoff of some 5,000,000 B/D of Iranian crude oil was softened to some extent by increased production from other sources, notably Saudi Arabia. The net effect of the cutoff on the world oil market was estimated to be a shortfall of about 2,000,000 B/D below demand for current needs and inventory rebuilding. This continuing shortfall caused spot market prices for crude oil to increase dramatically.

The major effect of the Iranian cutback, therefore, was to induce OPEC to increase prices beyond previously expected levels. The 2nd Quarter 1979 OPEC price hike was originally scheduled to be 3.8 percent. However, recognizing the willingness of spot buyers to pay prices well above market levels and the overall reduction in production, OPEC raised the price of crude by a full 9 percent to the originally scheduled fourth quarter 1979 price. In addition OPEC approved surcharges of up to $4 a barrel.

Even before the latest OPEC action which raised the oil price ceiling to $23.50 per barrel, the impact on downstream product markets of these crude oil market developments had been significant. They have, in fact, dramatically altered the historical relationship between the spot and term markets.

European spot markets have been significantly affected by shortfalls resulting from the Iranian production crisis and the subsequent effect on the world crude market. In effect, the Iranian production cutback has virtually eliminated excess capacity on world markets.

In view of all this, DFSC believes that future markets for petroleum will be far less secure than they have been and that alternatives must be found.

DoD studies show that for at least the next 40 years the military departments will remain dependent upon liquid hydrocarbon fuels. For this reason, the military departments and DoE have initiated joint research programs to develop military fuels from sources other than crude petroleum.

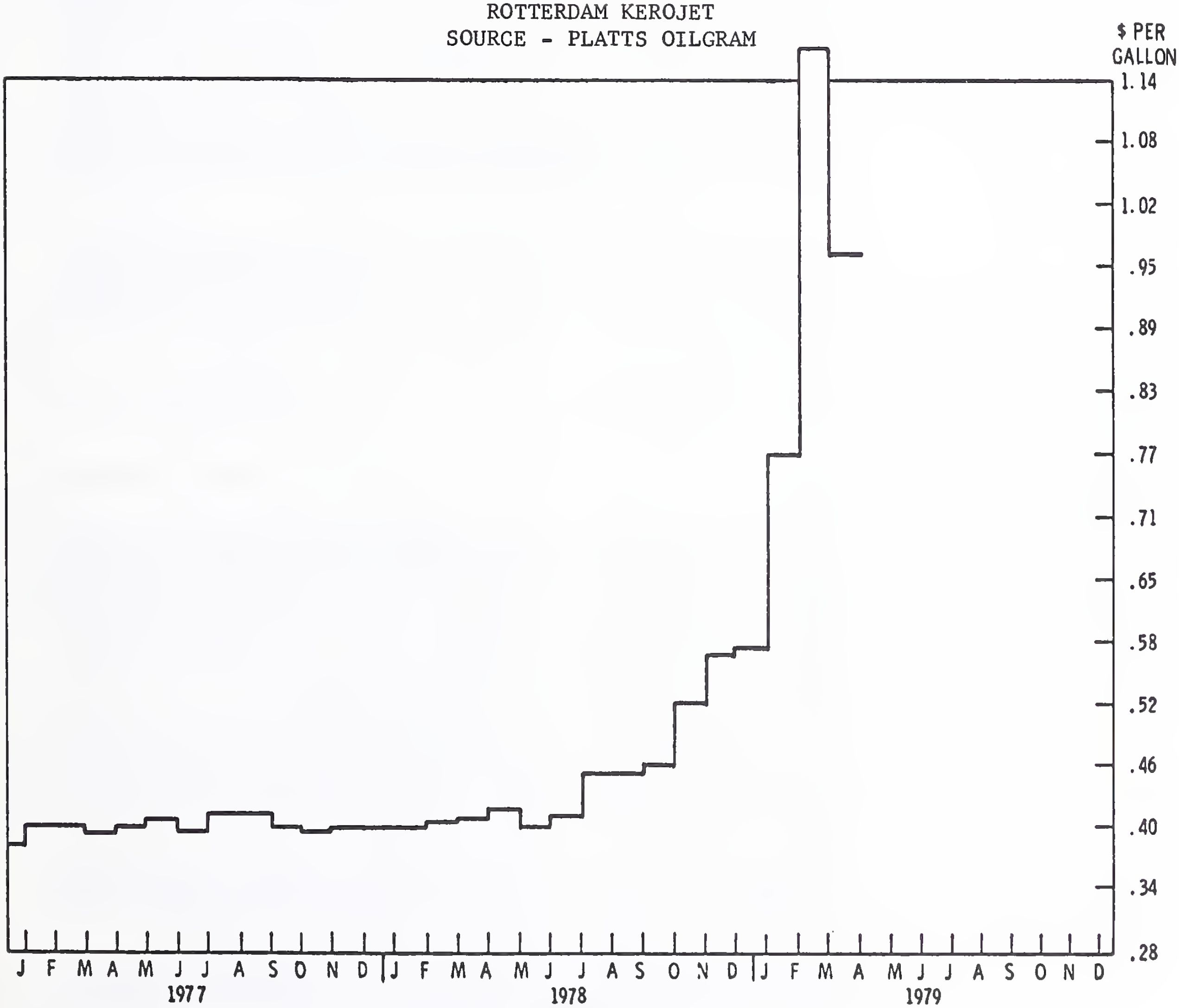
Recently 72,000 barrels of crude shale oil were refined at the Sohio Refinery in Toledo, Ohio,into JP-5, DFR, JP-8 and residual fuels. These fuels have been shipped to various contractors and military activities for testing in aircraft engines, ships' propulsion systems, and ground equipment. This research program was designed to develop methods to extract the oil from the shale, establish refining techniques and processes, and identify any production or specification problems which might occur.

Oil shale deposits in the United States are very substantial. Estimated, proved and probable crude oil petroleum reserves in the world currently total about 700 billion barrels. Recoverable oil shale in the world is estimated at twice that amount--about 14,000 billion barrels, with 72.7 percent located within the United States.

Currently the DoE has several research contracts to develop better and more economical methods

for removing the oil from the shale. These contracts are expected to yield between 500,000 and 800,000 barrels of crude shale oil over the next three years. DoE has offered this product to DoD for further experimental work. The DoD has determined that it is essential that this program be furthered and has requested DFSC to expand its involvement to include acquisition of the crude in addition to logistics support. Initially DFSC will acquire and store the crude as it is produced and later will distribute it as required by the experimental program.■

ROTTERDAM KEROJET
SOURCE - PLATTS OILGRAM



Proclamation 4667 of July 10, 1979

National Energy Supply Shortage

By the President of the United States of America

A Proclamation

The Secretary of Energy has advised me that the continued reduction in world crude oil production has resulted in a national energy supply shortage constituting a severe energy supply interruption as defined in Section 3(8) of the Energy Policy and Conservation Act (42 U.S.C. 6202(8)). The Secretary based his conclusion on the fact that current and projected imports of crude oil and petroleum products, plus available stocks, are not adequate to meet normal demand and that shortages of essential fuels have begun to have a major adverse impact on the economy with the possibility of more severe impacts occurring in the future. Recent shortages of gasoline in some areas of the Nation and the current inadequate levels of heating oil stocks have underscored the seriousness of the situation and demonstrate that action must be taken now to conserve available supplies of petroleum.

On the basis of the Secretary's report, and other information available to me, I hereby find and determine, in accordance with Sections 201(b) and 3(8) of the Energy Policy and Conservation Act (42 U.S.C. 6261(b), 6202(8)), the existence of a national energy supply shortage constituting a severe energy supply interruption, which:

(A) is of significant scope and duration and of an emergency nature;

(B) may cause major adverse impact on national safety or the national economy; and

(C) has resulted from an interruption in the supply of imported petroleum products.

I further find that implementation of the Emergency Building Temperature Restrictions, Energy Conservation Contingency Plan No. 2, is required by the severe energy supply interruption. This Plan was transmitted by me to the Congress on March 1, 1979, and approved by a resolution of each House (S. Res. 122, 125 Cong. Rec. S 5135 (May 2, 1979); H. Res. 209, 125 Cong. Rec. H 3018 (May 10, 1979)), which resolutions have been transmitted to me by the Secretary of the Senate and the Clerk of the House. Those resolutions were received by me on May 4 and May 15, 1979, respectively.

NOW, THEREFORE, I, JIMMY CARTER, President of the United States of America, by the authority vested in me by the Constitution and laws of the United States, including Section 201(b) of the Energy Policy and Conservation Act (42 U.S.C. 6261(b)), do hereby proclaim that:

Section 1. A severe energy supply interruption, as defined in Section 3(8) of the Energy Policy and Conservation Act (42 U.S.C. 6202(8)) currently exists with respect to the supply of imported crude oil and petroleum products.

Sec. 2. This finding shall be immediately transmitted to the Congress.

Sec. 3. The provisions of the Emergency Building Temperature Restrictions, Energy Conservation Contingency Plan No. 2 (44 FR 12911 of March 8, 1979), shall become effective as of July 16, 1979.

Sec. 4. In accordance with the provisions of the Plan, the Secretary of Energy is hereby authorized to issue regulations for the purpose of implementing the Energy Conservation Contingency Plan No. 2 and to administer the program in all respects.

IN WITNESS WHEREOF, I have hereunto set my hand this tenth day of July, in the year of our Lord nineteen hundred seventy-nine, and of the Independence of the United States of America the two hundred and fourth.

Jimmy Carter

[FR Doc. 79-21755
Filed 7-10-79; 4:40 pm]
Billing Code 3195-01-M

NEW STUDIES SET FOR SPR SITES IN TEXAS AND LOUISIANA

Energy Insider

The Department of Energy (DOE) has named Sandia Laboratories to direct geotechnical studies for Strategic Petroleum Reserve (SPR) sites in Louisiana and Texas.

About $7 million has been earmarked for the new, two-year geotechnical program. It will include geological site characterization, and design assistance and evaluation for both present and future storage sites.

Site characterization will cover assessment of geological, geographical and hydrological features of salt dome surfaces and caprocks; mapping of dome exteriors; and analysis of dome interiors to aid in site selection.

The best techniques and locations for excavating new storage caverns in two of the five existing facilities will also be studied. Each of these new caverns will be about 2,000 feet high and 230 feet in diameter and hold approximately 10 million barrels of crude.

Caverns are "leached" by injecting water into a borehole where it dissolves salt and leaves a void. This salty water, or brine, is then pumped to the surface and disposed of in deep wells or into the Gulf.

Three presently operating SPR sites--Bryan Mound, Texas, and West Hackberry and Bayou Choctaw, Louisiana--are filled to almost 60 percent capacity. The schedule calls for these sites to reach their 147 million barrel limit this fall, dependent upon oil availability. Two more facilities--Weeks Island and Sulphur Mines, Louisiana--are scheduled to begin receiving oil later this year. Their capacities are 75 million and 22 million barrels, respectively.

Plans then call for Bryan Mound and West Hackberry to be expanded to hold an additional 120 million and 160 million barrels, respectively. ■

DFR-NE--Trial Link With DFSC

Daniel D. Frazier
Directorate of Supply Operations

On June 1, 1979, the Defense Fuel Region, Northeast, (DFR-NE) and McGuire Air Force Base began daily entry of all government bills of lading direct to the IBM 370 computer at DFSC, using a leased Sanders remote terminal set and a dedicated telephone line. On July 1 this was followed by the additional entry of supply transactions submitted to DFR-NE by four selected Defense Fuel Support Points under DFR-NE jurisdiction (i.e., COCO/GOCO pipeline accounts).

The remote terminal set, comprised of an input keyboard, Cathode Ray Tube, (CRT) and printer, provides the capability to edit and validate input formats and data at the DFR, input validated transactions direct to DFSC, interrogate DFSC records, and receive printed listings and reports from DFSC.

Key objectives of these prototype actions are:

- To establish an operationally effective and efficient two-way communications link between DFSC and CONUS DFRs.

- To establish an effective and efficient means of transmitting low-volume transactions from contractor-operated DFSPs to DFSC in a timely manner and with acceptable accuracy.

- To establish a CONUS telecommunications network using current system documentations and transaction formats and provide for later transition to MILSPETS transactions and implementation of the Defense Fuel Automated Management Systems (DFAMS).

DFSC will evaluate the effectiveness of the system at the end of 90 days, using hard-copy source documents and trial records kept by DFR-NE. Concept refinements will be considered in light of the trial results (i.e., telecopier link between DFSPs and the DFR in lieu of telephone relay confirmed by hard-copy documentation). Final results will be published in a future edition of the Fuel Line. ■

OFFICE REDESIGNATION

Effective August 1, 1979, the Defense Fuel Quality Assurance Office, Middle East, a Defense Logistics Agency (DLA) Secondary Level Field Activity, reporting to the Commander, Defense Fuel Supply Center (DFSC), is redesignated as a DLA Tertiary Level Field Activity reporting to the Commander, Defense Fuel Region, Europe (DFR-E).

Small Business--Constant Struggle for Survival

Daniel R. Gill
Small Business and Economic Utilization Specialist

The American free enterprise system can be depicted as an arena in which two forces are engaged in battle. These two forces are identified as small business and big business. The winner is that force capturing the largest amount of the US business dollars. What a tragedy!

Small business is indeed a vital segment of our economy. It is the backbone of the American free enterprise system, representing 97 percent of all US business firms and employing approximately 60 percent of the work force, excluding the agricultural industry. Although these statistics might sound impressive, small business is constantly in a bitter battle for mere survival and not just the largest portion of the US business dollars.

Historically, small business has received very little assistance from corporate big business except in those cases where pure economics were involved. Small business is usually faced with the almost impossible task of fighting the economic advantage of big business. In addition, small business has not reaped significant benefits as subcontractors for Federal contracts awarded by the Government to large multinational corporations. Of the total dollars awarded to small business, the amount awarded by big business through prime contracts or subcontracts is relatively small or insignificant.

Although the Federal Government has been the major supporter of small business in the past, the new policy of opening up US business to foreign firms tends to dilute the emphasis on preference for small business in the United States. The new trade agreement lifting various restrictions on foreign business will reduce the number of potential contracts which have been previously set-aside for small business. American small business will have a difficult time competing with foreign firms since they generally have a greater opportunity to use cheaper labor, are not covered by stringent US Government regulations, and receive special treatment and subsidies from their governments that would give them an advantage in the US.

Even though the new trade agreement appears to favor big business, it has been said that the new agreement will benefit small business. Only time will tell. What is important though, is the fact that this country cannot survive without the entrepreneur and small business motivation for the Great American Dream. Without this vital segment of our economy, the country as a whole will suffer.

It is obvious that in the days of big business and big Government, small business will continue to fight the winless battle for the biggest piece of the US business pie. Unless big Government and big business take major steps to maintain the American free enterprise system, the danger is ever present that small business will continue to be left out and made to suffer.■

MEDITERRANEAN SHUTTLE TANKER

Ruth Norwood
Defense Fuel Region, Europe

The past six months have been eventful ones for the Defense Fuel Region, Europe (DFR-E) and the Joint Petroleum Office of Headquarters, United States European Command (JPO, USEUCOM).

On October 1, 1978, as a result of a joint recommendation by USEUCOM and DFR-E, the commander of the Military Sealift Command Mediterranean (COMSCMED) assumed operational control of a tanker engaged in Mediterranean shuttle service for direct support of the European command. Simultaneously, DFR-E assumed the role of ordering office for contracts with Mediterranean suppliers, while JPO compiled requirements and prepared the schedule.

The initial cargo was loaded aboard our first vessel, the USNS Sealift Indian Ocean, on September 28,1978, at Gaeta, Italy, where she began her dedicated support assignment to EUCOM. The Indian Ocean remained with us through strikes, bad weather, clogged piers, and other problems until mid-January when she was replaced by the USNS Sealift Pacific. From that date to the present it has been more of the same, with the addition of the Iranian crisis which brought its own set of problems.

In spite of all these challenges, DFR-E established good rapport with the local contractors. The scheduling officer in JPO submitted his requirements; the ordering officer in DFR-E placed the orders; the contractors' suppliers/ sub-contractors loaded the cargo and in response to MSCMED orders, the tanker steamed busily ahead delivering product to the assigned destinations as well as refueling ships at sea.

As the learning curve straightened, the average of barrels loaded and discharged and the number of depots served grew steadily each month. In addition, it became apparent that the operation of the direct-support tanker provided greater flexibility for the simple reason that it could react rapidly to changing conditions. The schedule was altered many times on very short notice to lessen the impact of adverse weather, strikes, delay in product availability or request for consolidation at sea. Despite all the last minute changes, we have maintained a good working relationship with our suppliers and customers, and as a result the former have complied with our requests in nearly every situation.

At the end of January, a meeting attended by personnel of MSCMED, Fleet Air Mediterranean, U.S. Naval Forces, Europe, EUCOM, and DFR-E was held in Naples to review the tanker's first four months of performance and discuss possible improvements. Actual performance data for the period September 28, 1978 through the end of January 1979 was compared to the evaluation criteria developed at the onset of the test period and the results were equal to or exceeded the standard in all instances where results could be measured. The same period for the previous year was used as a control for this comparison to determine the effectiveness of the local

supply concept. The results indicated that depot inventories for the current period were higher than the control period in spite of increased issues from these depots. In addition, level penetrations were fewer and of significantly shorter duration.

Major General Edward A. Partain, Chief of Logistics, USEUCOM, was briefed on the above data and expressed his gratification at the enthusiastic response received from our customers. He is convinced that the decentralized control concept gives optimum operational effectiveness and responsiveness from employed assets and provides a positive wartime training environment for our staffs under routine peacetime conditions.■

TURNING COAL INTO CAR FUEL IS COSTLY, BUT RESEARCHERS ARE OPTIMISTIC

Energy Insider

Turning coal into liquid fuel for cars is not a new idea; during World War II, the Germans synthesized almost all their motor and jet fuels from coal. But the prospect of converting coal to gasoline on a large scale, economical basis has not been seriously considered until quite recently. Now, work towards this objective is being conducted at DOE's Brookhaven National Laboratory.

Although synthetic gasoline would be more expensive to produce than a product refined from natural crude oil, it's becoming competitive. A plant which feeds 29,000 tons of coal per day would produce something like 48,000 barrels of motor gasoline and 160 million cubic feet of pipeline gas per day. The gas would cost about \$25 to \$40 per barrel. This is a composite cost--counting the gas as well as the oil.

In the DOE technique, coal is first pulverized to a fine powder and dried completely. It is then loaded into a feeder mechanism, at which point the system is pressurized with hydrogen gas. The coal drops by gravity from the feeder down an eight-foot long reaction tube. Here it is subjected to the intense heat and pressurized hydrogen which drive the reaction.

The products are then "quenched," or liquified, as they drop through a four-foot long cooling section. The resulting liquids, consisting of benzene, toluene, and sylene (the lighter oils), as well as heavier oils, are separated from the gases (primarily methane and ethane) by condensation. Any char is collected in a char trap at the bottom of the tube.

The crucial difference between DOE's research technique and older forms of coal liquefaction is the very rapid heat-up of the coal which is on the order of thousands of degrees per second. It is then cooled down almost as quickly to quench the hydrocarbon products, preventing their decomposition.■

Petroleum Trends and Impact on DoD

Lieutenant Colonel Adolfo Moncivaiz
Former Commander, Detachment 29

The purpose of this article is to provide an analysis of petroleum trends and the direct impact those trends have on petroleum logistics. In the past six months, petroleum has provided us with a classic example of the interrelationship between supply and demand.

Crude oil is a finite resource. What is taken out cannot be replaced. This concept is a key to the interplay between pricing, supply, and demand. In the past three years, the petroleum production rate in the United States has declined, and without new discoveries we can project further declines as currently producing wells become older. The same perception of declining production and declining revenues is a key factor in the planning of the OPEC countries. Their strategy calls for maximizing revenues without depleting their resources too rapidly. Iran provides a good example of this policy.

In prior articles I discussed the impact of the Iranian production shutdown which began in October 1978. That impact was not felt in the United States until about February or March of 1979. As a result of its need for revenues, Iran has come back into production again; however, the new government has not come close to its established production goal of four million barrels a day. The current Iranian output is about 3.2 million barrels per day, of which the United States takes 32 percent, Japan 18 percent, and Britain 16 percent. The rest of Iran's petroleum input is distributed through many, many users.

Figures on imports of OPEC crude into the United States are staggering in their relentless increase from 1973 to 1979. In 1973, these imports amounted to 2.9 million barrels per day. It now looks as if they will stabilize at between 5.6 and 5.7 million barrels per day. Meanwhile, however, the US demand for petroleum products has increased tremendously. For example, in 1973 the average was 17.3 barrels per day. The projected average for 1979 is estimated at 20 million barrels per day.

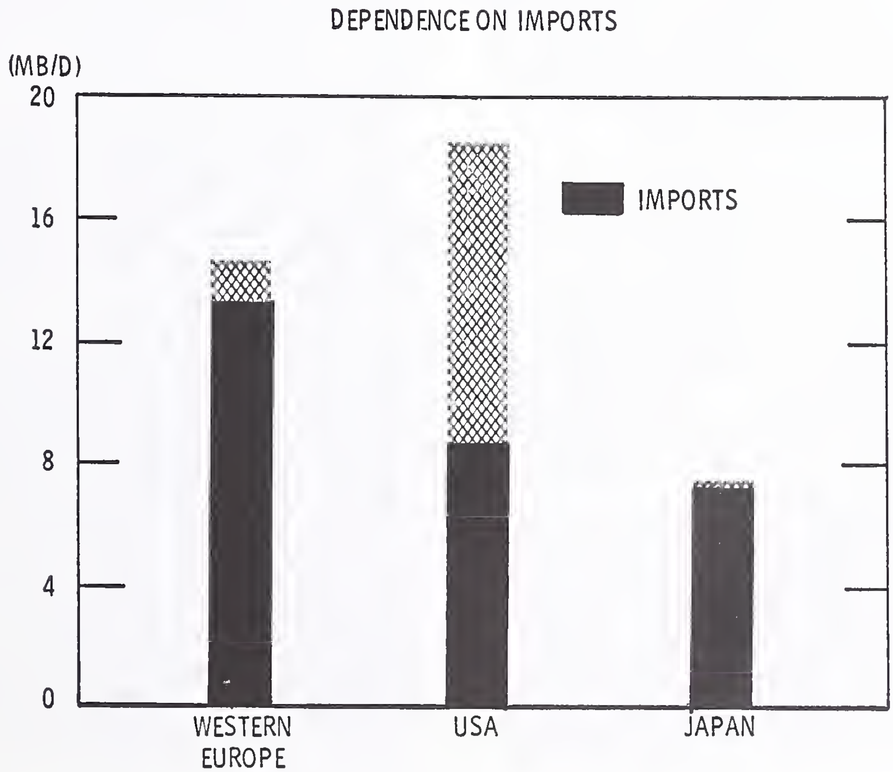
A factor that should not be lightly discounted as a means of slowing the oil drain is a worldwide effort at conservation. Although, admittedly, much of the conservation taking place today is primarily the result of increases in costs per barrel, several countries, members of the International Energy Association, have agreed to reduce total consumption 5 percent by the end of this calendar year. Such efforts are well underway. However, in line with its production policy, OPEC decreases production by 5 percent as soon as the demand drops 5 percent, thereby staying under the supply/demand equilibrium.

In theory, if OPEC can keep supply just below demand, it can exact increases in costs per barrel. There is however, a point of marginal return at which OPEC can no longer reduce supply or production efforts in order to pressure the prices up, although such a point is still a long way from posing a threat to OPEC.

Another development I have addressed in previous articles is the spot market and its pricing impact. We see this impact in the headlines every day when we read of prices in the range of 36 to 44 dollars being paid for a barrel of crude. Such headlines tend to exaggerate the real problem, since only a small percentage of the total production is traded in the spot markets.

A spot cargo is a very precious cargo. It represents product available over and above the long-term contracting arrangements that are made by the major oil companies; therefore, in a period of shortages spot cargoes can alter a country's position from one of shortage to one of supply adequate to meet the priority demands. Such cargoes are available, even though in very limited numbers, and they are moving to the highest bidders. The United States by executive request has dissuaded major US oil companies from paying much more than the official OPEC crude price.

In a previous article I ventured the opinion that as the prices for the spot market increased substantially, there would be a



propensity on the part of oil-producing nations to channel more product to the spot market. This, in fact, has happened. Currently some countries are shifting as much as 15 percent of their total production into the spot market. This is a very fragile game to play, however, because saturation of the spot market will cause prices to go down as has already happened in several markets. Rotterdam, for example, went through a cycle in which the prices were extremely high, and then saturation of the market caused them to drop almost to the established OPEC prices.

The pricing impact is there, nonetheless. What is important to realize is the fact that we are primarily satisfying DoD's overseas requirements in a spot market atmosphere. Long-term arrangements made by the major oil companies are made to satisfy commercial requirements in overseas theaters. Therefore, the impact of a high spot market price relates directly to the cost of fuel for DoD missions outside the continental United States.

Another factor which bears heavily upon the availability of product in the United States is the competition for production of distillates and motor gasoline. Normally, switching over to the production of distillates and heating fuels occurs in the latter part of June. Because refineries went into this switchover period with very low inventories this year, (the lowest inventories, in fact, that we have seen in recent history), the normal switching period had to be extended. Some of the major oil companies began switching to distillate production as early as the first of June. The availability of motor gasoline was directly impacted and, in some cases, related directly to longer gasoline lines.

Several factors affect the switchover period; among the most important are the undisrupted flow of crude into a refinery and the capacity of that refinery to produce the required products. Refining capacity in the United States is currently limited to about 17 million barrels per day while the demand for products approaches 19 million barrels per day. Refineries are currently running at 85 percent of capacity, whereas they should be at about 93 to 96 percent of capacity.

What, specifically, causes the delay in the flow of crude to the refinery is difficult to determine. Several reasons are offered by industry. One is that the disruption of supplies from Iran caused redistribution of assets worldwide and that the lag in that redistribution is only now catching up. Another is that, in order to maximize production, it's essential to get the right quality crudes to the right refinery, and it takes time to sort out all the crude oil qualities. Whatever the reason, however, the flow of crude into refineries is restricted; therefore capacity is restricted.

In May, President Carter mandated that special users of distillate products were to receive 100 percent of their requirements, in order of priority. Agricultural needs were first on the list. This action further depleted existing stocks. To date, DoE has allocated only motor gasoline, not distillates. However, the criticality of distillate supplies is evident throughout the northern and midwestern states and is expected to grow much worse

before the end of August. Commercial truckers are requesting priority allocation for distillates. DoD is actually standing in line for coverage of distillates and heating-fuel requirements to support strategically important military installations.

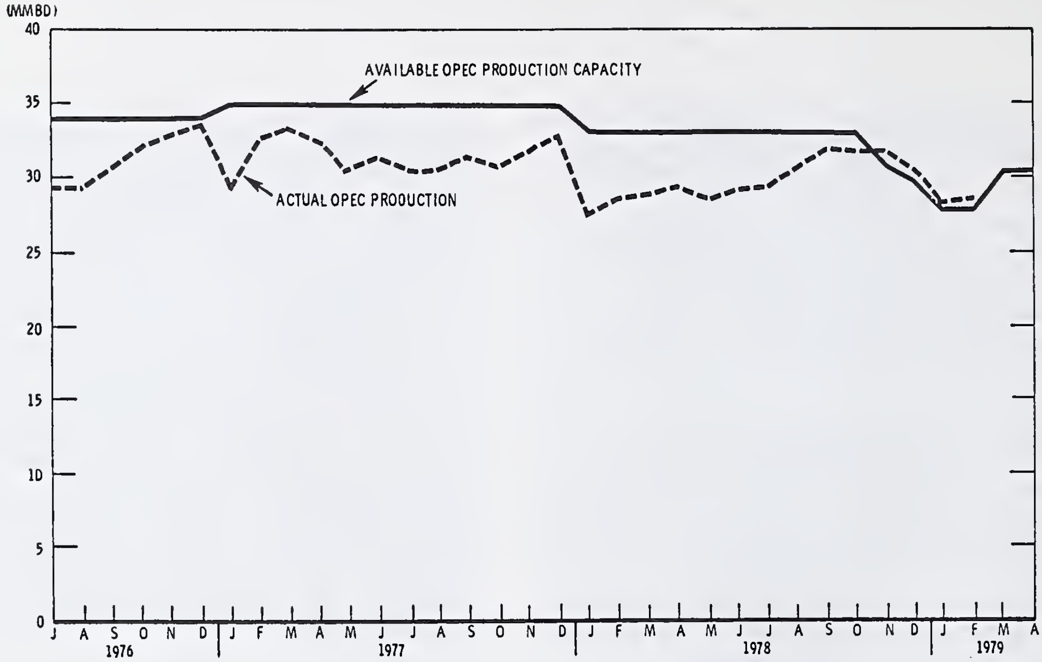
All kinds of proposals can be made about what should be done to maximize production of distillates and motor gasolines; for us in the petroleum business, however, it is a reality that production of one type of fuel can be maximized only at the expense of another. What we need is the establishment of a policy to determine which users have priority. The building up of critical distillate stocks to the level that DoE would like to have by October 1979, should receive top priority. Without that kind of priority, refineries, with their current capabilities, cannot increase DoD's stocks of distillates to a safe level.

We should be aware, however, that as more and more refining capability is switched over to distillates, we can expect more critical gasoline shortage during August. As we look ahead to world market prospects for the next six months it is no secret that the OPEC countries are attempting to maximize revenues without increasing production. In recent months, OPEC has indicated that a price increase is warranted. Prices for the market crudes such as Saudi light and Nigerian light are reaching 20 to 24 dollars. OPEC believes that in order to sustain its policy on maintaining reserves, it must increase the price of the petroleum it sells to those it determines are abusing energy. In doing so, however,OPEC penalized all users.

The OPEC countries have been requested by consuming nations to stabilize their price for six months. This stabilization is critical to those nations if they are to curb their inflation rate and maintain at least partial economic growth in face of higher costs. OPEC as a cartel, however, will act to reduce production in order to maintain the criticality of the supply and demand equilibrium. It will not supply more product than is needed to meet demand. It is to OPEC's benefit to maintain supply below demand and thereby command a higher price.

With such an announced strategy, changes in distribution patterns will become more and more evident. Traditionally, supplies from Arabian countries were primarily destined for the European theater, Japan, and the United States. Now, with the fluctuations in price and demand, some of those traditional patterns are being modified so that Arabian products are flowing to the Pacific as well as to some of the countries in Africa and Latin America. Countries which are in the developing stage will be increasing their demand and thereby effecting a change to the distribution pattern as it now exists. This will constitute one of the greatest impacts on United States petroleum supplies because we will have to compete for those products that we always assumed we could get as imports.

In the past few months, coverage for the Defense Department's requirements has been very limited. Contractors are hesitant to enter into any long-term agreements. A trend is developing which will require a six-month contract rather than an annual one. This is interesting in view of the fact



that most of our annual contracts now require escalation clauses which update the cost almost on a weekly basis.

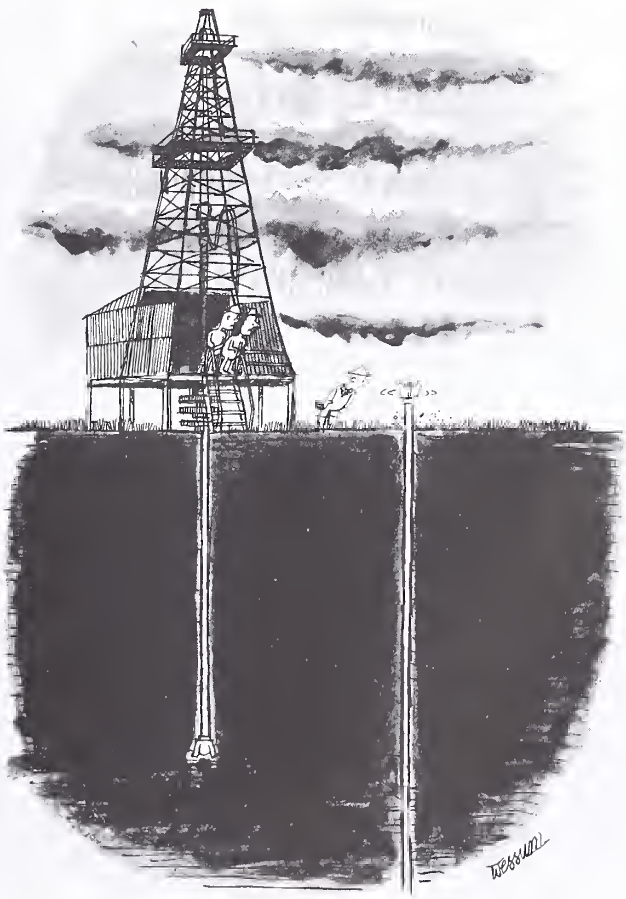
The greatest difficulty is found in procuring ground products. Recent solicitation for coverage of these requirements have resulted in an unprecedented number of uncovered items. We saw a shortage in coverage of all jet fuel requirements for the East and Gulf Coasts. The Atlantic/European/Mediterranean support looks dreadful. Some coverage is offered; however, we need coverage for the full requirements. Prices for the products required in the Atlantic/European theater are nearly approaching spot market prices. What constitutes an unreasonable price becomes relative considereng that our options are very limited.

Another area of impact is in substitution of product requirements. The limited availability of the desired products find DoD in competition for 100 percent support of its requirements. In addition to that, DoE is already questioning the criteria for 100 percent support of DoD's requirements as established in DoE's own regulation. Therefore, we are going to find ourselves substituting products for requirements that cannot be satisfied with the desired products.

On the requirements side, stricter criteria must be developed for determining danger points on inventory levels. The criticality of resupply must be viewed in light of existing contractual coverage and terminal support. Limited contractual support necessitates special efforts by DFSC to develop the necessary data to demonstrate to DoE that we lack support in critical areas. Certainly no one in DoD can accept disruption of resupply to the point of mission failure. We are committed to doing everything within our power to get the fuel where it is required, even if this requires extraordinary transportation and distribution efforts.

There are a number of options available to the Department of Defense to obtain critical supplies. DoD can request a return to the provisions of the Defense Production Act. It can ask DoE to broaden allocation regulations to ensure critical supplies. Or, DoD can continue to reduce its petroleum consumption. The last is the option preferred by DoE, and it is the only one being pursued by DoD at the present time, with the exception of direct mission requirements. We are no closer to the first and second options today than we were six months ago.

As we continue to work through the problems that confront us day-by-day, however, we might be well advised to make sure that the light we see at the end of the tunnel isn't affixed to the locomotive of a train headed our way. ■



A Year in Review

Captain Brian R. Lenz, USAF
Executive Officer
Defense Fuel Supply Center

The purpose of this article is to recount in general terms some significant events that involved the Defense Fuel Supply Center in the past year. I have been the executive officer for DFSC for the last twelve months and have seen these events unfold firsthand.

When I arrived in July 1978, DFSC was handling routine, everyday problems under the steady leadership of Major General John C. Raaen, Jr., who had commanded DFSC since shortly after the 1973-74 oil embargo. At his side was Captain Robert L. Ringhausen, USN, an expert at stirring the pot and asking needling questions. Supply Operations was busy maximizing inventory levels for the end of the fiscal year. Coal was being put away for the winter season in spite of the problems with fines, free-swelling index, and contract disputes. An agreement was reached to connect Edwards Air Force Base to a pipeline.

Procurement was faced with reduced contract coverage and only truck support to historically pipeline activities. The Defense Fuel Automated Management System continued to draw fire from the military services. The U.S. Air Force conversion program to JP-8 (F-34) in the United Kingdom was proceeding smoothly, calling for accelerated deliveries of JP-8 and thereby straining DFSC ability to support.

Many other equally significant items were being methodically addressed and effectively resolved. In the wings at DFSC (USAF Detachment 29), a faint cry of doom was heard that the sky was falling--a complaint that historical pipeline customers must take truck deliveries. It was at this time that Captain O.W. Hamilton, Jr., USN, jumped aboard just in time to see the storm pick up.

Crude oil prices started to climb very slowly in the fall with rumors of an OPEC price increase effective 1 January. A Belgian refinery strike in September started the spot cargo prices soaring. The base price of JP-4 went from 49¢ to 53¢ per gallon and higher. The question was whether to buy at this high price or wait for things to stabilize. In a week's time, over 1.2 million barrels a day of crude were lost as a result of an oil industry strike in Iran and the shutdown of the Iraq-Turkey pipeline. November showed an almost complete cessation of crude exports from Iran.

By February the effect of the reduced crude were becoming painfully clear. DFSC established a contingency task force to deal with this energy crunch. The allocation process was implemented by DoE, resolving some problems of distribution of available stocks but playing havoc with existing procurement activities. As spring arrived, Captain Hamilton steadied the ship while Major General Raaen was replaced by Brigadier General Lawrence R. Seamon, USMC.

The decrease in fuel availability brought increased attention and new challenges to the fuels community. This has resulted in above-par promotions for fuels managers, with ten 0-5's making 0-6 this year. They are Army Colonels McLean, Bachman, Bagdavon, and Stover; Navy Captains Filipiak, O.L. Johnson, Lavely, and Weatherson; and Air Force Colonels Custer and Lee.

The high visibility and scrutiny of fuels procedures is expected to continue next year. Hopefully, things will stablize and we can get back to routine problems.

All this highlights the critical nature of fuels logistics to the US economy and national defense and demands that we continue to do our best. ■

Service Awards in DFR Europe

W. J. (Jake) Riley, Quality Assurance Manager, DFR-E, recently received a Special Achievement Award from Colonel Robert R. White, Commander, Defense Fuel Region, Europe.

Military-Owned Vehicle Plan

Nick Friedrich
Directorate of Supply Operations

Under normal conditions, DFSC utilizes the assets of commercial transportation companies to provide movement of petroleum products to DoD and other selected Government activities. On June 14, 1979, a fire and explosion at the Pride Refinery in Abilene, Texas, extended DFSC supply lines to more distant sources of supply to meet the needs of activities who were receiving fuel from Pride. The longer distances made it impossible for commercial carriers to meet movement requirements due to a lack of equipment or appropriate operating authority.

At the same time, the independent truckers' strike and a general shortage of diesel fuel added to the difficulty DFSC was experiencing in obtaining satisfactory tank-truck support. Solicitations to obtain motor carriers ready, willing, and able to provide service under a grant of temporary intrastate authority issued by the Texas Railroad Commission went unanswered by commercial motor carriers. To meet mission requirements, tank car assets were shifted in Texas, and on June 22 DFSC requested the Military Traffic Management Command (MTMC) to implement the Military-Owned Vehicle Plan (MOVP) primarily in support of Dyess Air Force Base, Texas.

The MTMC Basic Emergency Plan and FORSCOM Regulation 500-1 provide guidance, establish procedures, and assign responsibility for the management, control, and emergency use of military fuel-carrying vehicles to transport critically needed fuel to DoD installations when commercial fuel delivery capability is inadequate or nonexistent. Military-owned fuel-carrying vehicles are used after all efforts to secure commercial transportation have been exhausted, and their use is on a case-by-case basis tailored to meet actual needs.

DFSC provides the required movement information to MTMC, to include origin supply point, destination, type of fuel, total volume, number of gallons required per day, and duration of movement. When directed by the MTMC, the United States Army Forces Command (FORSCOM) has the responsibility to locate the required military equipment and assign the appropriate FORSCOM region to make the line haul. The applicable Defense Fuel Region assigns the line haul to the installation or installations in the region area which have the capability to accomplish the line-haul mission.

The installation assigned to make the line haul coordinates pickup and delivery schedules with the cognizant Defense Fuel Region prior to departure and notifies the region coordinator when the fuel-haul mission is completed. Constant coordination and update of information is maintained between DFSC, FORSCOM, MTMC, and shipping and receiving activities.

The MOVP was activated on June 25, 1979 and approximately ninety 5,000-gallon military tank trucks, domiciled at Fort Hood, Texas,

began delivering JP-4 to Dyess Air Force Base, Texas. The trucks were provided by the 13th Corps Support Command (COSCOM), 1st Cavalry Division, 2d Armored Division, and 6th Cavalry Brigade (Air Combat). Control of the fuel shipments was provided by the 13th COSCOM Movement Control Center at Fort Hood.

The trucks moved in three 30-vehicle convoys with a total capacity of approximately 150,000 gallons each. Support vehicles such as maintenance and refueling trucks and a military police escort accompanied each convoy. Shipments continued until sufficient commercial carriers were obtained.

The MOVP gives DFSC additional transport flexibility to provide adequate and timely fuel deliveries to the military service. In a time of uncertain fuel supplies and a general shortage of commercial fuel transport equipment, the MOVP is essential to the DoD logistics readiness posture. ■

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reserves, reserves

Petroleum Today

The word "reserves" has many different meanings in different areas of activity.

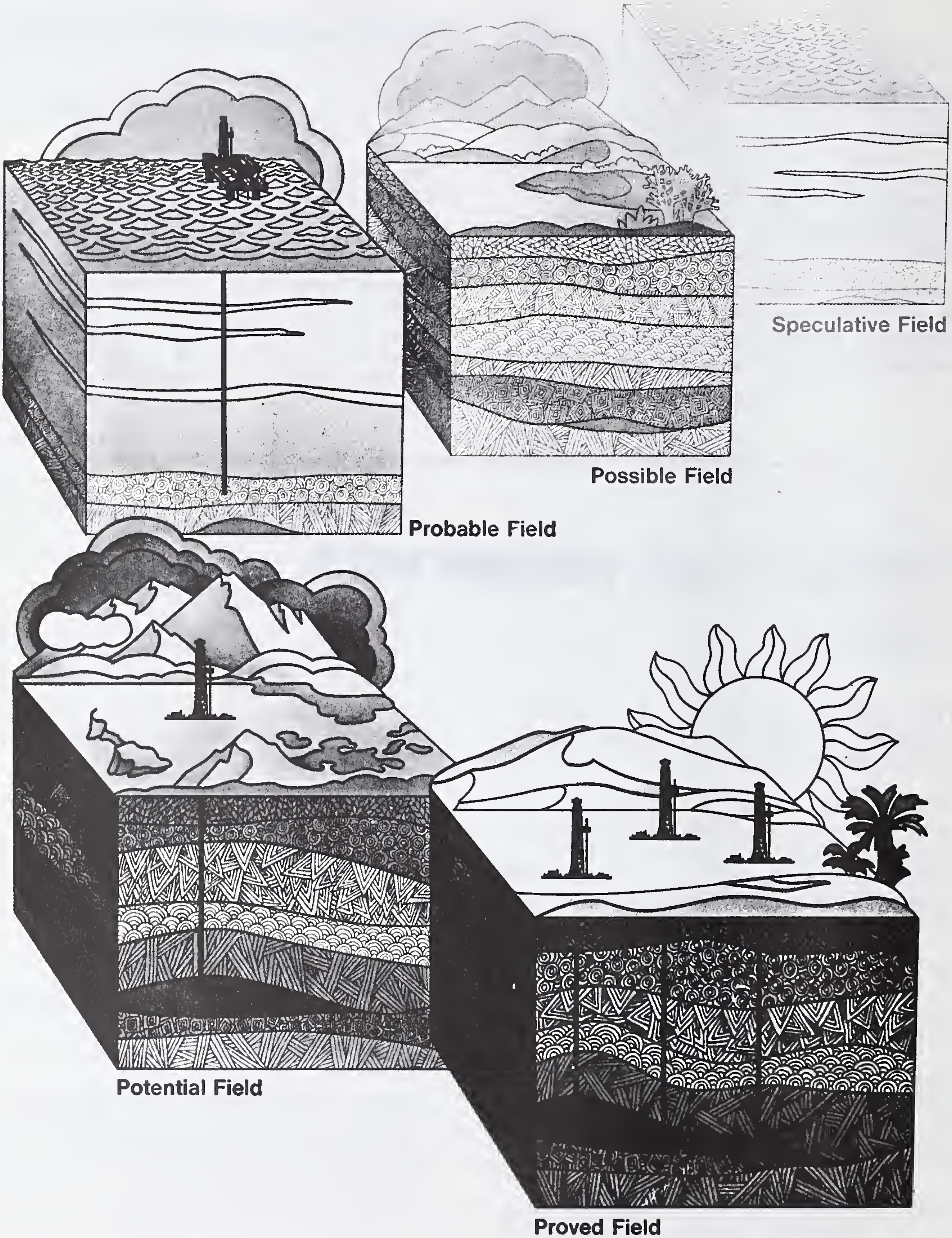
For example, to a financier, reserves may be cash or other assets being held aside to meet future demands. To a grain farmer, reserves may represent crops which have been harvested and placed in storage. To a general, reserves may be either part of an army being held in readiness to reinforce the line or trained personnel not currently on active duty.

And, to cite one more example, the nation's gold reserves have been mined, molded into heavy bars, and neatly stacked under heavy guard at Fort Knox, Kentucky.

Persons familiar with reserves in those contexts understandably may have trouble understanding exactly what oilmen mean when they talk about the nation's petroleum reserves.

For one thing, the petroleum industry itself recognizes several categories of reserves. The most reliable category--the only one the nation can rely on with a high degree of confidence--represents oil which has been found by drilling and is believed to be recoverable under existing economic and operating conditions. This oil makes up the nation's proved reserves.

Ranging outward from proved reserves are potential reserves, probable reserves, possible reserves, and--the haziest of all--speculative reserves.



Speculative Field
Possible Field
Probable Field
Potential Field
Proved Field

Potential oil reserves are estimated on the basis of data from drilled wells, geological interpretation of core samples and other information, or on the basis of some actual petroleum production. Such oil (or natural gas) may be classified as potential because unlike proved reserves, it is not yet economically recoverable. The oil or gas may be in an area that is too far away from available transportation facilities, or perhaps more drilling is needed to determine the commercial value.

Probable reserves are not yet discovered, but the area may look good because, for example, it closely adjoins a producing field.

Possible reserves are oil and natural gas which have not been found but which might be expected to occur because the underground structure of a new area closely resembles that of a productive field several miles away.

Speculative reserves are those which may lie beneath unexplored areas such as the Continental Shelf off the U.S. East Coast. In such areas, seismic studies show an underground structure that is different from proven fields, but that could theoretically trap petroleum. No wells have been drilled with the goal of producing oil or natural gas. Trying to estimate volumes of petroleum in such areas is pure guesswork.

No matter which category is being discussed, any reserves numbers are only guesses, and subject to change when more information becomes available. Unlike grain, gold, cash, or troops, oil and gas reserves cannot be precisely counted or measured. They have not been produced and placed in storage. They lie miles beneath the earth's surface, and even the most experienced geologists and engineers may study identical data and reach different conclusions about the amount of oil down there and the volume that can be recovered.

Even though oilmen sometimes refer to an "oil pool" as part of their professional jargon, oil is not actually found in lakes or pools. It cannot be measured by poking a dipstick down a hole. It accumulates in small pockets inside certain kinds of rock, frequently in association with salt water. After 116 years of experience, the petroleum industry still needs all the ingenuity it can muster to figure out with reasonably accuracy how much oil is in the ground, how much it can expect to bring to the surface, and the best way of getting the job done.

No two fields are exactly alike, so experience is never an infallible guide. A recovery technique that worked well in one field may be a flop in another. When this happens, oilmen try something else--until they find a technique that works.

Furthermore, as a field is explored and developed further, every new fact learned may have some bearing on reserves estimates, requiring the original figures to be raised or lowered. Only after a field is completely exhausted can everyone agree on how much recoverable oil it once held. ■

Contracting for Lubricants and Petroleum Speciality Products

Charles F. Hardman
Directorate of Contracting and Production

The current shortfalls DFSC is experiencing in obtaining contractual coverage for all of DoD's requirements for lubricants and specialty products have not happened suddenly. Since the oil embargo of 1973, what had been a buyer's market with ample supplies has changed to a seller's market with critical shortages.

In this environment some manufacturers, with an eye to economics and profit margins, have eliminated many specialty products and displayed less interest in tailoring products to strict military specifications. This is especially true when they have no assurance of getting future contracts or making a reasonable profit.

In addition, the proliferation of contract clauses, based on statues, in government contracts leaves many firms disinclined to do business with the government. If we add the present political climate between government and the oil industry, it becomes apparent why there are fewer sources and less competition in the market place.

It is difficult to generalize and state that certain factors or procurement procedures are the reasons for delays in contracting for these items; however market conditions and required procurement procedures can be identified that contribute to the lack of availability of these products. The following are some of the problems that are being experienced in contracting.

● Sole Source or Sole Offers. This is the root of most contracting difficulties. When the contracting officer is in a sole source situation or does not expect competition, regulations require solicitation by RFP and negotiation procedures prevail. If no competitive offer is received, the submission of certified cost or pricing data and audit that are necessary to develop a basis for negotiation and to determine price reasonableness present problems and delays.

The process of obtaining pricing data, negotiating, and contract review usually extends beyond the expiration date of the offer. When the offeror is requested to extend

Review of military specifications would probably enhance both product availability and competition among suppliers.

his offer, too often the cost of materials has risen and the offeror must adjust his offer price upward or withdraw the offer. This means more time is lost in renegotiation or resoliciting for the same requirement. Also, many qualified suppliers refuse to offer on an RFP because they do not want to commit themselves to a quantity of product or a price in the current volatile market.

● Shortages of Raw Material and Allocation. A shortage of base stocks and blending oils has developed in the industry during the past few months, and manufacturers are allocating to the suppliers who historically have furnished specification products to meet DFSC requirements. This means that when a solicitation goes out, prospective offerors must get a commitment from their base-stocks suppliers for sufficient quantities of blending oils before they can bid. In the past, DFSC received three or four qualified formulations on each bid, based on availability of blending stocks from several manufacturers. Recently, however, the Center has been receiving only partial coverage of requirements with formulations based on blending stocks from only two major manufacturers. Additionally, suppliers are experiencing a shortage of additive chemicals and this has caused delays in delivery on some contracts.

DoE's current allocation policy is for the Military Departments to receive 100 percent of their requirements from industry on a prorated basis. There is a problem, however, since the allocation is made to the base-period supplier,or historical supplier, which means that DFSC must turn to the same suppliers from which it was unable to obtain full coverage previously.

The manufacturers of blending stocks who supply DFSC's historical contractors would in many cases have an allocation exemption from DoE, since they could plead insufficient quantities of high-quality crude oil available to refine bright stocks and neutral oils for specification products required by DoD. At the same time DoE is disinclined to resort to allocation until DFSC can prove that it has exhausted all possibility of obtaining coverage for lubricant requirements through normal procurement methods.

● Escalation provisions in long-term contracts. DFSC's requests for large quantities of lube oils and greases for posts, camps, and stations are covered in annual, bulletin-type contracts. These indefinite-quantity contracts require escalation provision in order to provide equitable price adjustments during the course of the contracts.

The EPA clauses currently used for these products are based on an escalation formula which is related to changes in the Bureau of Labor Statistics (BLS) index on a month-to-month basis. This method of increasing prices has proved unsatisfactory in recent months and is not considered equitable by contractors. Hence, the continued use of this escalation provision jeopardizes long-term contracts for this type of requirement. It is evident that a new EPA clause must be developed for these procurements. DFSC has been working with

suppliers in an effort to get their ideas for a more equitable escalation basis for these contracts.

There are constructive steps the Military Services might take to counteract the disinterest on the part of contractors in qualifying or developing products to meet military specifications.

The Services should work to reduce the time and cost to suppliers for qualifying their products. In addition, where feasible, specifications should be revised to be more in line with readily available commercial products. The utilization of commercially acceptable products would make military solicitations more economically attractive to industry and should improve availability and competition in the acquisition process.

Making the government a more desirable customer, whenever this can be done without impairing mission performance, could go far toward eliminating the critical shortages the military are currently experiencing in many areas.■

CARBON DIOXIDE FLOODING STUDIED FOR ENHANCED OIL RECOVERY

Department of Energy

Carbon dioxide might be used to stimulate additional crude oil recovery from certain fields in the Los Angeles Basin, according to a DOE-sponsored report.

The study, titled "Carbon Dioxide Recovery and Tertiary Oil Production Enhancement in the Los Angeles Basin," estimates that the per-barrel cost of the oil would range from $12 to $20.

However, even if a particular reservoir was a prime candidate for carbon dioxide flooding, it would take at least three years of study and design work before carbon dioxide injection could be started, the study says.

The report estimates that carbon dioxide injection in Los Angeles Basin oilfields could recover about 6 or 7 percent additional oil over what might be expected from waterflooding. This amounts to some 100 barrels of oil per acre-foot that carbon dioxide flooding could provide.

The report (SAN/1582-1) is available from BOE's Bartlesville, Oklahoma Energy Technology Center and DOE's Technical Information Center in Oak Ridge, Tennessee.■

DFQAO Caribbean Has New Contractor

William T. Biggs
Defense Fuel Quality Assurance Office
Caribbean

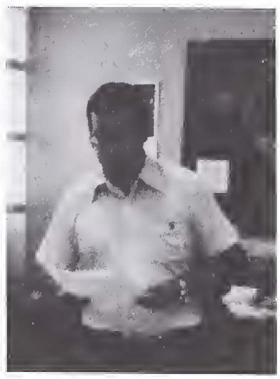
The first shipment from the Lagoven Refinery in Amuay, Venezuela, was made during April 1979. The cargo of low sulphur Navy Special Fuel Oil (NSF) was destined for U.S. east-coast consumption.

F. Martinez (left), Laboratory Quality Control Section Head, and Charles Rivet, Quality Control Coordinator, discuss cargo shipment.

The prime contract is a small business set-aside held by a minority-owned company in New York. Lagoven is the subcontractor. This is part of DoD's effort to promote small business in the tight petroleum market. The products will be low sulphur NSF and marine diesel fuel (DFM). This is not the first finished petroleum product we have bought from the Amuay refinery.

Prior to nationalization, Exxon was the refinery name at Amuay. Exxon provided several types of fuels to the military under U.S. Government contracts until 1976. DFQAO Caribbean retained a residency on the company premises, represented by one QAR, while these contracts were active. The U.S. Government had had no contracts for fuel in Venezuela since 1976. The Venezuelan Government nationalized their petroleum industry on January 1, 1976.

It is expected that about one cargo a month will be shipped from Lagoven during the next twelve months. ■



Rafael Parra
Laboratory Superintendent

The Seven Sisters

Marilyn Buchan
Directorate of Contracting and Production

Did you ever hear the term "Seven Sisters," and then conjure up a vision of a childhood book and try to remember the story that goes with it? Well, the seven sisters of this article would make for good fairy tale reading. Their stories are almost too incredible to be true. It has to do with petroleum and a world appetite for this scarce resource, which has come a long way since the days of Marco Polo, the famous Venetian traveler. He described in his writing the great oil wells at Baku on the Caspian Sea as "a fountain from which oil springs in great abundance inasmuch as a hundred shiploads might be taken from it at one time." If Marco Polo could just see us now!

The term "Seven Sisters" came into being possibly as early as 1913 at the time of the New Jersey Corporation Acts. It came into common usage in the 1950's when Enrico Mattei, of the Italian State Oil Company and later of the Italian-government-owned AGIP, pitted himself against the "oil cartel" which he called "le sette sorrelle" translated from Italian to mean "the seven sisters."

The sisters are, of course, the big seven of "Big Oil" (another term that you see now and then in the media): Exxon, Socal, Mobil, Texaco, Gulf, BP, and Shell. The backgrounds of the companies are interesting.

EXXON, SOCAL, and MOBIL

From the earliest finds in the Pennsylvania oil fields in 1859, to the Texas heyday of Spindletop, to the forums of the Middle East, the name of John D. Rockefeller can never be forgotten. The father of the Standard Oil family, he was the nation's first real tycoon, starting with absolutely nothing but a good head for mathematics and accounting. Until the famous anti-trust action against his concerns in 1911, he dominated the industry, gobbling up rivals and setting up the vertical forestructure of the modern oil business, that of producing, refining, transporting, and distributing the oil. It was claimed at the time that he had used every method possible to undercut his rivals, e.g., secret rebates to railroads, circumventing laws that prohibited a company in

- Illustration by Karen Tresvant

one state from owning shares in other states, and taking advantage of the independents in every way to force them to sell out to him.

By 1870, after only seven years in the business, Rockefeller was able to establish a joint-stock company called the Standard Oil Company. Because of the widespread impact of his actions, the machinery of Congressional investigation, which has dogged the American oil industry ever since, came into existence. The Standard Oil monopoly which was resistant to U.S. laws for so long was dissolved in 1911 to form the following:

- Standard Oil of New Jersey (now Exxon)

- Standard Oil of New York (SOCONY) (now Mobil)

- Standard Oil of California (SOCAL) (now Chevron)

These three of the seven sisters were still accused of collusion for many years after the breakup.

GULF and TEXACO

These two sisters grew out of the Texas oilfields in 1901: Gulf created by the Pennsylvania Mellon Bank family and Texaco by a maverick called "Buckskin" Joe Cullinan, who had once worked for Rockefeller. His backing came partly from the famous and wealthy Hogg family of Texas. Both firms grew by leaps and bounds, the pattern of growth already established by Rockefeller as their handbook.

The remaining two sisters have a European background:

ROYAL DUTCH SHELL GROUP

Marcus Samuel, the founder of Shell, was a shrewd London entrepreneur, who inherited a fortune from his trader father. The beginnings of Shell were, unbelievably, in Russian oilfields. The Rothschilds of France and the Swedish Nobels had obtained a concession to prospect for oil in the Russian Caucasus. Marcus Samuel became involved when he combined his sales talents with the advent of oil

tankers designed to be safe enough for passage through the Suez to Singapore and Bangkok.

Against the overwhelming odds of competing against Standard Oil which had moved to the overseas markets in the late 1800's, Samuel finally sought the help of his country, England. A firm begun by Henri Deterding of the Dutch East Indies, called Royal Dutch, soon came up against both Shell and Standard Oil and the three of them fought for control of the foreign markets for sixteen years until Samuel of Shell finally decided to ally with Royal Dutch in a joint company called Asiatic. In 1906, the new giant of Royal Dutch Shell was formed, 60 percent Dutch, and 40 percent British.

BRITISH PETROLEUM

Winston Churchill, a budding Liberal politician, became First Lord of the Admiralty in 1911. He was disturbed by the fact that the British Shell had more or less succumbed to Dutch influence and control. He became even more concerned when the price of oil went up and up and up (sound familiar?). The British Navy had been talked into converting to oil from coal by Shell lobbyists and representatives of the Burmah Oil syndicate (a Scottish oil firm).

Churchill eventually sought out the Anglo-Persian Company which had been formed by Burmah Oil in Alliance with an English gentleman, William Knox D'Arcy. D'Arcy, in 1901, had arranged a concession with Teheran, Persia's Grand Vizier, covering 480,000 square miles in exchange for 20,000 pounds, 20,000 shares of stock, and 16 percent of the net profit. Only three months before the outbreak of World War I, the British Government, after long negotiations, bought 51 percent of the Anglo-Persian company, now known as BP.

The structures of the seven sisters who had become major powers before 1920 soon looked alike--they were integrated business corporations controlling not only production, but transportation, distribution, and marketing. "Upstream" business of drilling and producing at the oilfields was followed by massive profits from the "downstream" activities of distributing and selling at the pumps. Their names became household words as mass production of automobiles and airplanes started in the 1920's. What was so disturbing for the advocates of free enterprise was the fact that the giants tended to cling together in consortia as they ventured further abroad and appeared to have tacit understanding in order to better control the marketplace.

One often heard the term "monopolies" in days of old to describe the oil companies. The term oligopoly better fits the type of industry from which the seven sisters flourished into giant corporations, larger than some governments. An oligopolist produces a fairly homogeneous product whose attributes are touted to the world in differentiated qualities. Therefore, Exxon may have the same product, e.g., gasoline, as Shell, but each claims its product is better than the other for the car. Advertising brand names, patents, trademarks, custom, and specifications explain away the product differences.

In this type of market, there may be few or many sellers depending on the marketing area, but each seller has a degree of control

over the going price. Supply and demand can often be controlled by an oligopolist industry. For example, if there appeared to be a glut of oil causing keen competition in falling prices, it used to be a simple enough matter to reduce refinery operations. Products would then become scarcer and with demand the same, prices would rise. This maneuvering has become increasingly difficult in the petroleum industry as Department of Energy (DoE) processes more pricing and allocation regulations. The industry is also very conscious of public concern about product availability and has taken various steps to improve its image.

Seasonal changes from the production and use of oil products for heating homes to those for recreational uses still create changes in supply and demand factors and produce vagaries in prices. Of course, oil prices today rarely go down, thanks to the diplomacy of OPEC!

No matter the bad press the seven sisters occasionally receive, the efficiencies of their largeness must be acknowledged as well as their ability to perform the necessary research and development to help our nation progress. The profit incentive must be there for the corporations to satisfy stockholders and remain viable entities in their field.

Beginning with the Sherman Act (1890), regulation and control of the oil industry has persisted. The Sherman Act, which made it illegal to monopolize trade and outlawed all combination or conspiracy in restraint of trade, was the basis for the 1911 Supreme Court breakup of Standard Oil. There have been further legislation and court decisions over the years strengthening U.S. antitrust laws. The Federal Trade Commission, established in 1914, is the watchdog agency for antitrust violators. Additionally, consider the myriad of restraints imposed by volumes of Department of Energy regulations!

The seven sisters are only a small part of the petroleum family today. They are joined by many other multinationals, independents, small business, etc. Many of these are tied to the big seven by exchange agreements, consortia (North Sea, for example), pipeline sharing, tankering pacts, processing arrangements, and so on.

The giant conglomerates are often accused of growing larger by inordinate exaction of profits and unchecked monopoly. This is not a new accusation against successful merchants, as evidenced by the writing of a Scythian philosopher named Anacharsis, in 600 B.C., who described the agora (an open plaza for commercial shops) in Athens in the following way: "The market is the place set apart where men may deceive each other!"

The seven sisters and other members of their petroleum family are most necessary to our everyday existence. They feed our insatiable thirst for products to run our cars, industries, homes, and planes. Byproducts become our clothes, medicines, toys, fertilizers, laundry and bath soaps, petrochemicals, et al. Our national and international defense framework would grind to a halt without the petroleum family. It is most difficult to imagine a lifestyle without petroleum. This was perhaps best stated by J.H.A. Bone of Philadelphia in 1865, long before any of us were born, in his book, "Petroleum and Petroleum Wells":

"From Maine to California, it lights our dwellings, lubricates our machinery, and is indispensable in numerous departments of arts, manufactures, and domestic life. To be deprived of it now would be setting us back a whole cycle of civilization. To doubt the increased sphere of its usefulness would be to lack faith in the progress of the world."

We need to remember, now and then, that without the initiative and foresight of the founders of the seven sisters and the others that followed, the United States would probably not be the most modern industrialized country in the world. ■

This article was extracted from an essay, "Events Which Have Affected Competition in DoD Petroleum Procurements," prepared by Ms. Buchan for a University of Virginia course in May 1976. Basic research for this article came from two sources: "The Seven Sisters--The Great Oil Companies and the World They Shaped," Anthony Sampson, The Viking Press, Inc., 1975; and "Economics," Paul A. Samuelson, Institute Professor, M.I.T., McGraw-Hill, 1973.

Need Motor Gasoline?

Marianne Behm
Directorate of Supply Operations

American Motorist are again faced with long lines at the gasoline pumps. The gasoline situation is no less serious for a significant number of DFSC customers. DFSC is busily trying to assist activities and provide product sources when our current contractors find themselves unable to deliver needed fuel.

DOE has revised the base period for motor gasoline to November 1977 thru October 1978 in lieu of the 1973 time frame previously used. This should provide some relief as we will be working with more current data. The new base period was directed by the Department of Energy Economics Regulatory Administration (DOE/ERA) (Title 10 of the Code of Federal Regulations, Part 211), as effective at least through September 1979. Based on the latest information from DOE/ERA, the base period is now fixed from November 1, 1977 thru October 31, 1978.

Procedures for obtaining gasoline when current contractors are unable to meet an activity's requirements, or when DFSC has not been able to provide contractual coverage, have been widely disseminated to many field activities. The basic steps we are taking in our efforts to assist the various field activities have essentially remained constant and can be summarized as follows:

● Activity should initially place all orders for gasoline with the current DFSC contractor. Even if he can't supply the entire requirement, do accept whatever he offers.

● For a requirement the current contractor cannot deliver, or if no contract exists, open market purchases should be attempted. This should include the activity's base year supplier. (If gasoline is readily available on the open market, default action against the contractor should be considered.)

● If product is not available on the open market, then the base-period supplier must honor the remaining requirements out of his allocation.

● If the base-period supplier has difficulty in supplying fuel, communication should be made with the Regional Department of Energy Office. Appropriate state officials may also be contacted to see if any state-set-aside quantities can be released to meet the particular activity's needs.

If all of the above fail, or if questions arise while pursuing the above steps, DFSC-PPA should be contacted. They will be in a position to assess the situation to make certain all approaches have been considered. ■

Increasing Crude Prices Spur Move To Develop Nonconventional Oil Reserves

International Petroleum Times

Although traditional sources of crude oil are in short supply, the world has barely scratched the surface of non-conventional sources such as heavy oil, tar sands, and shale oils. Proved non-conventional oil reserves are already many times the reserves of conventional oil. Oil costs are approaching the levels at which both coal liquefaction and extraction of non-conventional oil become attractive.

Although there is limited exploitation of heavy oils and tar sands at the moment, their production costs are no longer significantly higher than that of conventional crude. They are getting increased attention since they offer a number of attractive features. Already proved reserves are immense. Most heavy oils and tar sands are in politically stable parts of the world. Even more important, they can be processed and handled using existing techniques and equipment.

Heavy oil is not a precise term but covers conventional oil with a gravity of up to 50^{o} API. These oils usually do not flow at ambient temperatures and are deficient in light ends. The extreme case is tar sands which are the most dense and viscous of the heavy oils. Because tar sands predominantly occur close to the surface they can be exploited by strip mining.

The world heavy oil reserves are vast. The Olenek field in the USSR alone is thought to contain some 600 billion bbl. Reserves in the non-communist world are currently estimated at 4,000 billion bbl, mostly in Venezuela and Canada. The Venezuelans after a re-evaluation of reserves in the Orinoco petroleum belt have revised reserve estimates from 700 to 3,000 billion bbl while Canadian reserves, predominantly in Alberta, are estimated at 960 billion bbl. The USA's latest estimate of heavy oil reserves are 175 billion bbl.

Although these are oil-in-place figures and recovery ratios are likely to be low, the sheer size of the resource is seen when contrasted with reserves of conventional oil. World reserves of conventional oil are currently estimated at 650 billion bbl and present estimates usually put the volume of ultimately recoverable reserves at no more than 1,700 billion bbl.

The simplest method for recovering heavy oil is to strip mine the deposit and extract the oil from the substrate using heat and chemicals. Environmental problems remain to be fully solved but this general exploitation scheme is already in operation in the Athabasca tar sands in Canada. Strip mining is practicable (though not necessarily environmentally desirable) to a depth of 150-200 feet. In Athabasca about half the tar sands lie within 200 feet of the surface but in Venezuela only 10 percent of reserves lie this close to the surface.

The greatest prize is development of an economic "in-situ" technique. At the moment a great deal of

research is going into "in-situ" technique recovery. The two most promising techniques are steam injection and "in-situ" combustion, sometimes referred to as fire flooding.

At the moment limited heavy oil production occurs in the Bolivar Coast of Western Venezuela and California, both using steam injection. An 8,000 b/d project is in progress for the Orinoco Petroleum Belt, and the second Canadian mining scheme (Syncrude) is scheduled for a production of 130,000 b/d by 1982.

Indicative production cost of crude oil equivalent *$/bbl

Arab Light (excl. producer govt. take)	4
North Sea	6-12
Shale oil (USA)	20-25
Heavy oils (in-situ)	15-25
Tar Sands	20-30
Coal Liquefaction	25-35

*Cost includes upgrading to approximately Arab Light yield, delivered to demand centre, assuming 10 percent return but no taxes or royalties. Source BP papers.

Mining and extraction can give recovery ratios of up to 90 percent while recoveries from steam or combustion lie in the range of 10 to 50 percent. The economics of heavy oil production are subject to a wide range of variables and hence all figures must be treated with some caution. The US Department of Energy has estimated that the minimum price of oil required to justify oil produced by steam drive at $11-16/bbl and for "in-situ" combustion $13-20/bbl.

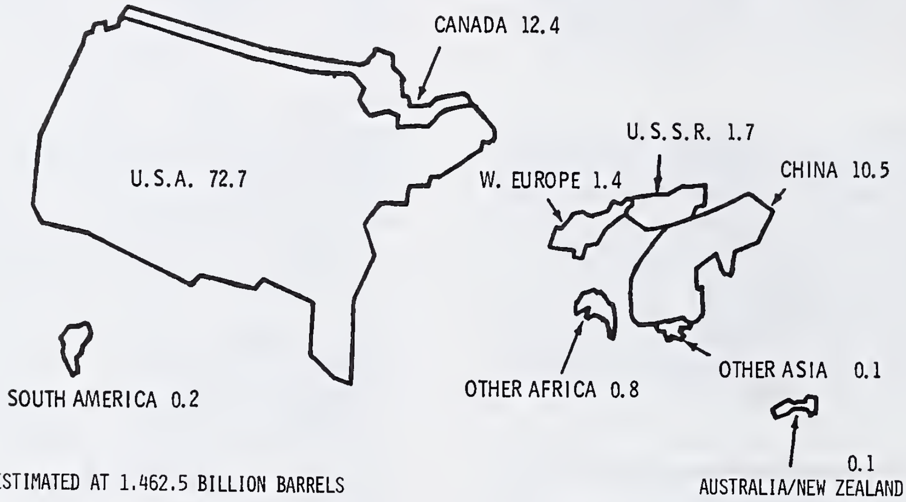
BP*, in a paper presented at the recent conference on the future of heavy crude and tar sands estimated that a somewhat higher price was required. According to BP, to produce a 'syncrude' giving a product yield equivalent to Arabian Light delivered to a major demand centre and giving 10 percent real return but excluding tax and royalties would cost $15-25 if produced "in-situ" from heavy oil, and $20.30 from tar sands.

The present price of crude is already bringing heavy oil projects into the area of realistic options. Both Venezuela and Canada are stepping up activity. The next few years should see new programmes being implemented.

Environmental impact, availability of water and manpower are all likely to restrain the growth of heavy oil exploitation. According to the BP paper, these restraints combined with the high capital requirements may restrict heavy-oil developments in Canada and Venezuela to some six 100,000b/d projects in each country over the next 20 years. Current costs of a 100,000b/d syncrude facility are estimated at $3 billion, a figure which is in the same cost area as the $2.5 billion BP are planning to spend on the Magnus field in the North Sea for 125,000b/d production.

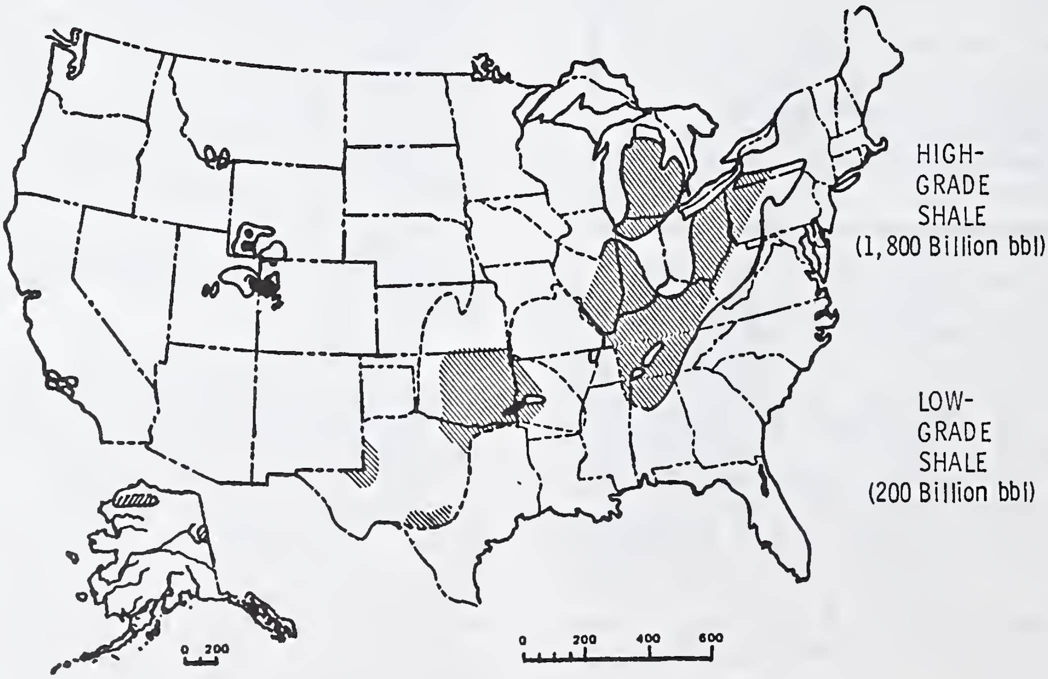
The other non-conventional hydro-carbon source attracting increasing attention is shale oil. Like heavy oil, the resource base is vast and concentrated in politically stable parts of the world. Current estimates are that the US has shale oil reserves of 2,200 billion bbl, Brazil 800 billion bbl, USSR 115 billion bbl, and Zaire 100 billion bbl with small deposits occurring in a

WORLD RECOVERABLE OIL SHALE
(PERCENT)



TOTAL ESTIMATED AT 1.462.5 BILLION BARRELS

PRINCIPAL REPORTED OIL-SHALE DEPOSITS OF THE UNITED STATES



BUREAU OF MINES ESTIMATE

large number of countries. The technology of shale oil extraction is less advanced than for heavy oils and tar sands and is subject to a number of fundamental drawbacks.

Shale oil is chemically bonded to the substrate and has to be 'cracked' free at elevated temperatures. The 'cracking' process causes the shale to swell by up to 40 percent, which means the volume of discarded shale is considerably greater than the volume extracted.

Work has been done on the "in-situ" extraction using underground combustion and if this can be perfected it will overcome the principal environmental problem, though it is generally thought that availability of water will be a major constraint of extraction.

The BP paper estimates US shale oil costs as \$20-25/bbl, rising a further \$2.3/bbl for "in-situ" extraction. The composition of shales varies quite widely usually in the range of 10 to 70 gallons of crude shale oil per ton of rock processed. In the past very rich shales have been burnt directly in boilers like a low-grade coal. All the present work aims to extract the shale oil and then process it to saleable products.

The processing of heavy oil and tar sands into a suitable refinery input can be achieved in a number of ways. The first surface mining project in Athabasca operated by Great Canadian Oil Sands (GCOS) extracts the "tar" from the sandstone by treating it with alkaline hot water. The material separated in this way, up to 90 percent of the tar in place, is then upgraded by delayed coking and hydrogeneration to yield stable distillates.

The plant has been in operation since 1967 and produces up to 40,000b/d. In the second Athabascan plant, owned by Syncrude Canada Ltd., the upgrading is achieved by fluid coking and hydrogeneration. The distillates produced are then pipelined to conventional refineries.

The aim of both processing groups is to crack the high molecular weight polymeric material, predominantly asphaltenes. Asphaltenes account for 16 to 25 percent of the extracted tar sand material. The high content of oxygen, nitrogen, and sulphur are the principal nuisance materials. When it comes to the processing of Venezuelan heavy oils the average molecular weight is lower but there are high sulphur and heavy metal contents to contend with.

The development of heavy oil resources is still in such an early state that rapid change can be expected now that the resource is moving into the area of practical economics. Because heavy oil is by definition a high-cost source of hydrocarbon liquids, its large-scale development is dependent on a more favorable tone and environmental legislation regime.

The other major hydrocarbon resource, coal, is also attracting greater attention as the price of conventional crude soars. Utilized as a boiler fuel, coal is already competitive with oil in much of the world. Lack of handling and transportation facilities allied to lack of suitable boilers and stocking areas areas has meant that increases in coal consumption since 1973 have been relatively small, about 2.5 percent per year in the last five years worldwide.

Although this trend can be expected to increase and accelerate, the area that bears most directly on oil company activity is the liquefaction of coal. Current estimates are that coal conversion to benzene and diesel oil using the updated Fischer-Tropsch process becomes competitive at a crude price of around $25/bbl. The figure was given by Heinz Hiller of Lurgi in a statement in which he pointed out that although this processing route, which is currently used by SaSol in South Africa, is now commercially attractive, building a major plant would take four to five years.

Other sources have taken slightly less favourable views of coal liquefaction, estimating the required and sustained oil price to be in the $30-37/bbl for the US and $30-44/bbl for N.W. Europe using imported coal.

All the alternative liquid hydrocarbon sources require oil prices to exceed $25/bbl to be economically attractive and even then would require favourable tax treatment in the producing countries. The very long lead times on equipment and facilities means that these 'new' oil sources are unlikely to make any significant impact before the late 1980's, even if programmes were activated immediately.■

A FAMILIAR RING?

"There is one obstacle to further advance. . . .The increasing price of fuels necessary to work machinery. Coal and oil are going up and are strictly limited in quantity. . .We are spendthrifts in the matter of fuel and are using our capital for our running expenses.

"In relation to coal and oil, the world's annual consumption has become so enormous that we are now actually within measurable distance of the end of the supply. What shall we do when we have no more coal or oil?

"Alcohol makes a beautifully clean and efficent fuel. . .we can make alcohol from sawdust, the waste product of our mills. . .from cornstalks and in fact from almost any vegetable matter capable of fermentation. Our growing crops and even weeds can be used. The waste products of our farms are available for this purpose, and even the garbage from our cities."
--Alexander Graham Bell, before the District of Columbia's McKinley Manual Training School graduation, February 1, 1917.

DON'T WASTE ENERGY!

A TREE GROWS IN AMUAY

William T. Biggs
Defense Fuel Quality Assurance Office
Caribbean

Lagoven Refinery located in Amuay, Venezuela, recently started delivering fuel on a DoD contract. During the pre-award survey at the refinery by the DFQAO QAR, a giant old tree was observed in an area within the refinery where a building project was starting.

The centuries old tree was situated among the Divi-Divi trees, a very common tree in northern Venezuela and the South Caribbean islands. The local nature lovers were upset with the thought that the lovely old tree would be uprooted and destroyed with all the other foliage to clear the way for the new expansion program for the Venezuelan refinery.

After a series of hurried meetings, a high-level decision was made by the Venezuelan government's personnel operating Lagoven Refinery to "save that tree". Consequently, it was decided that an expert tree surgeon should be hired to supervise the relocating of the tree into new surroundings.

The new home for the old tree is the front entrance of the refinery. The author visited the refinery three months after the tree's relocation and reports that the old tree appears to enjoy its new neighborhood.■

Venezuelan scrub oak tree before replanting.

A Venezuelan Divi-Divi tree.

Relocated scrub oak tree outside Lagoven Refinery. (Photos by William Biggs)

Spring 1979 Defense Petroleum Course

Roy Breece
Office of Planning and Management

The Spring 1979 Defense Petroleum Course (DPC) was held in the International Hotel, New Orleans, Louisiana, during the period June 11 to 15.

Louisiana is a national leader in petroleum production and is heavily involved in offshore drilling and the importing of crude oil. The port of New Orleans is the second largest port in the nation in terms of tonnage handled. No wonder, then, that the American Petroleum Institute (API) has selected New Orleans as a permanent site for the DPC.

The Spring '79 course was outstanding in every respect. In view of the fact that this was first for industry in the area, it is evident that a great deal of effort went into planning and preparation both by API and participating industry members.

Participants were: Continental Oil Company; Gulf Oil Corporation; LOOP, Incorporated: Phillips Petroleum Company; Shell Oil Company; and Texaco, Incorporated. We would like to take this opportunity to thank them for a job well done.

Special thanks to J. Ray McDermott and Company, Incorporated, for a very interesting tour of their offshore platform fabrication yards and to DoE for Michael Cushman's fine presentation on the Strategic Petroleum Reserve Program. Our special thanks also to Shell Oil Company for an excellent tour of their Norco Oil Refinery and Capline Pipeline Control and Operations Center.

The course was made up primarily of students from the Department of Defense (HQ, DLA, DFSC, DCAS, DIA, CINCPAC, Army, Navy, and Air

Offshore drilling platform under construction at the J. Ray McDermott shipyard.

Floating crane used to set offshore drilling platforms and equipment in place.

- Photos by Allierson Henderson

Force) with some representation from the Department of Energy, Department of State, Central Intelligence Agency, and the American Petroleum Institute.

Colonel James H. Kovach, Deputy Director of Transportation, Energy, and Troop Support, DCSLOG, Department of Army, presented the 54 students with DFSC Certificates of Completion.

Space allocations for the DPC are a responsibility of DFSC-LP. (DFSC coordinator, Roy Breece, 274-7804 or 274-7808.■

Members of the Spring '79 Defense Petroleum Class

- Photo by API

Fission, Fusion, or Confusion?

Fadhil H. Khattat
Environmental Control Office

The purpose of this article is to describe nuclear power as an alternative source of energy. Nuclear energy is derived principally from two types of atomic reactions: fusion and fission.

Fission means bombarding radioactive atoms for the purpose of generating heat. In a typical nuclear reactor, the heat produced is regulated to change water into steam which turns the generators or turbines in a power plant to create electricity. Fission involves the breakup of atomic nuclei such as those of uranium to release energy and by-products called isotopes. Fission has become a major source of energy in the last two decades, utilized extensively in power generation and several technological and research applications.

Fusion, on the other hand, entails the joining together--a fusion--of the nuclei of light atoms such as hydrogen to release tremendous quantities of energy. Although not a new concept, as evident from the production of the hydrogen bomb, controlled fusion energy research and development is progressing slowly. Fusion power is expected to be an attractive alternative energy source about the year 2000.

The source of fusion fuel is deuterium, found and easily extracted from sea water, and tritium, which has to be bred in a fusion reactor much like plutonium in a fission-breeding reactor. One estimate puts the energy extracted from one gallon of water, using fusion of atoms, to the equivalent of 300 gallons of gasoline. As a former chairman of the Nuclear Regulatory Commission put it, "Developing controlled fusion would be equivalent to suddenly discovering that the Pacific Ocean basin is completely filled with a high-grade fuel oil instead of saltwater, and that it would automatically refill itself 500 times as its contents are consumed."

If uncontrolled, however, fusion may turn into a disaster! Fusion power requires temperatures of about 100,000°C. There are no materials on earth that can withstand such tremendous heat. At such temperatures, everything vaporizes into electrons and nuclei that constitute a fourth state of matter called plasma which is neither solid, liquid, nor gas. This is why controlled or fusion-containment systems are receiving top research priority at the Nuclear Regulatory Commission and the Department of Energy.

Research findings to date suggest that controlled fusion may be attainable through magnetic containment systems and through the application of laser to heat the fuel. It is too early to give research details on these, since the information available is highly technical and still preliminary. Many studies have pointed out that more research is needed to assess the size, cost, operating characteristics, radiation hazards, and environmental effects of a fusion reactor. The ultimate

objective is to develop fusion reactors that are both economically and operationally feasible with no danger of an explosive accident.

The technology for nuclear fission as a source of power is very well developed and used in several advanced countries. In the United States, there are 29 nuclear power stations generating electricity, 55 being built, and 76 in the planning stage. The licensing lead time for the construction of nuclear power plants has been reduced to accomodate increased demand for power. This is due to the dependence of fossil power plants on fuel oil, natural gas, and coal, which either are in short supply or have environmental problems that are costly to control. Thus, fission power is a readily available resource to replace rapidly depleting fossil fuels.

Nuclear power plants obtain heat energy as mentioned earlier by splitting atoms of heavy elements such as uranium. The uranium fuel used in existing reactors releases about 20,000 times as much heat as can be obtained from an equivalent weight of coal. Breeder reactors currently under development will maximize heat generation and the ratio may reach as high as 1,500,000 times that of equivalent weight of coal. Natural uranium known as ^{238}U contains about 0.7% of ^{235}U, the isotope that undergoes fission into plutonium, releasing heat within a reactor. For this reason, natural fuel must be enriched by increasing the concentration of ^{235}U. The Nuclear Regulatory Commission exercises considerable control over the nuclear power industry and sets standards for and licenses all nuclear facilities.

There are several types of nuclear power reactors utilized to generate electricity. Among these are the light water reactor (LWR) and the light metal-cooled fast breeder reactor (LMFBR). The latter is in the developmental stages which will eventually eliminate the need for gaseous diffusion plants. The first type must possess and ensure a much larger supply of nuclear fuel if it is to prove successful. There are several problems associated with both types, among which are discharge of waste heat to lakes or rivers, reactor safety problems, and handling of toxic plutonium. The breeder reactor, nevertheless, will have several advantages including 40 percent thermal efficiency and less reliance on the costly natural uranium in short supply.

The use of nuclear energy is likely to expand further and may receive accelerated support in view of the short supply of other fuels in recent years. To what extent the public will accept nuclear power depends largely on environmental protection and safety standards established and the willingness of the private sector to absorb their costs.■

FISSION-FUSION GLOSSARY

Atom--The smallest particle of an element which retains the physical and chemical properties characteristic to that element. It has a charged core around which negatively charged electrons constantly spin, making the atom electrically neutral.

Deuterium--An element which displays chemical properties nearly identical to those of hydrogen but with an additional neutron in the nucleus of the atom.

Electrons--Negatively charged particles which form the outer shells of atoms of all elements. They are also the primary carriers of electric current.

Fission--A process in which atoms of heavy elements are split yielding several atoms of light elements. Usually such splitting occurs with a loss of total mass of the material which is transformed into energy.

Fossil--In the context of fuel, a combustible material comprised of organic matter which is extracted from the earth's crust. Oil and coal are primary examples of fossil fuels.

Fusion--A process in which atoms of light element such as hydrogen combine to form atoms of heavier elements. Usually such a process occurs with a loss of total mass of the material which gets transformed into energy.

Hydrogen--The lightest of all elements with an atomic number of 1 and an atomic weight of 1.008. It is a gas at normal temperature and pressure.

Isotopes--Any two or more species of atoms of a chemical element with nearly identical chemical properties but differing in atomic mass (i.e., the number of neutrons in the nucleus) are referred to as isotopes of the element.

Lithium--A very light metal with an atomic number of 3 and atomic weight of 6.94.

Magnetic mirror--A device used to confine ionized, high temperature atoms by making use of the principle that such ionized atoms undergo reflections when they move from a region of low magnetic flux density to a region of high magnetic flux density.

Neutral beam heating--A method by which magnetically confined ionized gas is heated to a very high temperature. First a super energetic beam of neutral gas atoms is produced which is then directed towards the ionized gas to be heated. As the neutral gas atoms enter the region of the plasma, they become ionized, thereby providing a source of hot ionized particles which heat the remaining plasma.

Neutron--An uncharged elementary particle that has a mass nearly equal to that of a hydrogen atom.

Nucleus--The positively charged central portion of an atom that comprises nearly all of the atomic mass. It consists of protons and neutrons.

Plasma--An ionized gas medium consisting of positively charged particles and electrons exhibiting macroscopic electrical neutrality.

Radioactivity--The spontaneous emitting of energetic rays by the disintegration of the nuclei of the atom. (A property exhibited by heavy elements such as uranium).

Reactor--A facility in which energy such as heat or electricity is produced by means of either fission process or fusion process.

Tritium--An isotope of hydrogen which displays chemical properties nearly identical to that of hydrogen but which has two additional neutrons in the nucleus.

Uranium--A silvery heavy radioactive poly-valent metallic element that is found especially in pitchblende and uraninite and exists naturally as a mixture of three isotopes of mass numbers 234, 235, and 238.

"WOOD CHIP OIL" PRODUCED BY DOE AT OREGON PLANT

Energy Insider

"Wood chip oil," a synthetic petroleum made from lumber waste, has been produced for DOE at a biomass plant in Albany, Oregon. Approximately 900 pounds of wood chips were used during a 30-hour test run which produced the initial barrel.

Lawrence Berkeley Laboratory (LBL), which is directing the program for DOE, said the oil is equivalent to No. 6 bunker fuel, a heavy residual suitable for use in ships and for generating electricity.

According to LBL, if wood chip oil were produced commercially it might bring $26 a barrel, well below some spot market prices today.

Rust Engineering, which recently contracted to operate the biomass plant, produced the No. 6 product and expects to make a finer grade oil in tests later this summer. Attempts by previous contractors to produce synthetic fuel at the Albany facility resulted in a sludge-like substance which clogged pipes in the converter.

The process being used by Rust Engineering involves treating the wood with a catalyst at elevated temperatures and pressures to convert it to oil.

LBL says that 20 to 60 percent of a tree is wasted in lumbering operations. The waste could become fuel in a biomass plant.■

DFSC Briefs Advanced Petroleum Course Officers

The Defense Fuel Supply Center continues to provide one-day briefings at DFSC Headquarters, Cameron Station, in Alexandria, Virginia, to U.S. Army Reserve units taking two weeks of active duty training at the U.S. Army Quartermaster School, Fort Lee, Virginia.

On May 4, the 469th Quartermaster Group (Petroleum), Albuquerque, New Mexico, was briefed on DFSC operations and the European Pipeline System. The 475th Quartermaster Group (Petroleum), Farrell, Pennsylvania, received similar briefings on June 15. Senior staff member of one group described the day at DFSC as the highlight of their two weeks of training.

An additional benefit was the initial coordination both groups made with the DFSC Supply Operations Directorate's Transportation Distribution Division for possible future training commitments of their subordinate units.■

Petroleum Data Report, 1978

Department of Energy

U.S. energy production in 1978 increased for the third consecutive year. The 61.0 quadrillion Btu produced in 1978 was 0.63 quadrillion Btu or 1.0 percent greater than that during 1977 and represented the largest annual increase since 1972.

Petroleum (including crude oil, lease condensate and natural gas plant liquids) was the nation's principal domestic energy source in 1978, supplying 33.8 percent of total production. This is the largest share attributed to petroleum since 1974 and reflects not only the increase in Alaskan North Slope production, but also the continued decline in natural gas production and reduced bituminous coal and lignite production, the result of a major labor strike.

Consumption of refined petroleum products, the major item of energy consumption, was 37.79 quadrillion Btu in 1978. This represented 48.4 percent of total energy consumption and was 1.6 percent greater than the 1977 level. Since 1975, total consumption of petroleum has increased at an average annual rate of 4.9 percent. Natural gas and coal consumption declined slightly during 1978.■ (See chart page 49.)

PETROLEUM SUPPLY AND DISPOSITION
(Million Barrels per Day)

	1973	1974	1975	1976	1977	1978 [1]
Supply						
Production						
Crude oil	8.78	8.38	8.01	7.78	7.88	8.67
Lease condensate	0.42	0.40	0.37	0.36	0.37	([2])
Natural gas plant liquids	1.74	1.69	1.63	1.60	1.62	1.57
Total production	10.95	10.46	10.01	9.74	9.86	10.23
Imports						
Crude oil [3]	3.24	3.48	4.11	5.29	6.62	6.21
Refined petroleum products	3.01	2.64	1.95	2.03	2.19	1.98
Total imports	6.26	6.11	6.06	7.31	8.81	8.19
Other supply						
Other refinery input [4]	0.03	0.04	0.04	0.04	0.05	0.05
Unaccounted for crude oil	([5])	−0.03	0.02	0.08	−0.01	0.13
Processing gains	0.45	0.48	0.46	0.48	0.52	0.49
Stock changes [6]	−0.14	−0.18	−0.03	0.06	−0.55	−0.02
Total other supply	0.34	0.31	0.49	0.66	0.02	0.65
Total supply	17.55	16.89	16.55	17.70	18.69	19.08
Disposition						
Exports	0.23	0.22	0.21	0.22	0.24	0.33
Crude oil losses	0.01	0.01	0.01	0.01	0.02	0.02
Domestic demand by sector [7]						
Residential and commercial	3.20	2.92	2.76	2.99	2.97	3.02
Industrial	3.24	3.17	3.01	3.40	3.77	3.83
Transportation	9.26	9.03	9.14	9.56	9.92	10.09
Electric utilities [8]	1.61	1.53	1.42	1.51	1.77	1.80
Total domestic demand	17.31	16.65	16.32	17.46	18.43	18.73
Total disposition	17.55	16.89	16.55	17.70	18.69	19.08

[1] Preliminery.
[2] Included with crude oil.
[3] Includes imports for Strategic Petroleum Reserve.
[4] Includes benzol, other hydrocarbons, and hydrogen.
[5] Less then 5,000 berrels per dey.
[6] Negetive numbers denote e net addition to stocks or a reduction in supply, positive numbers denote a net withdrawel from stocks or en addition to supply.
[7] See Explenetory Note 1 on page 7.
[8] These deta ere demands by (or deliveries to) electric utilities and do not equate to consumption by electric utilities.
Note: Sum of components may not equal total due to independent rounding.

DISPOSAL OF HAZARDOUS WASTES

George Farris and Kathleen Harrigan
Environmental Control Office

The Federal Register of December 18, 1978, contained proposed rules issued by the Environmental Protection Agency under Sections 3001, 3002, and 3004 of the Solid Waste Disposal Act. These proposed hazardous waste guidelines and regulations are concerned with criteria for identifying and listing hazardous wastes, identification methods, and a hazardous waste list; standards applicable to generators of such waste for record-keeping, labeling, containerizing, and using a transport manifest; and performance standards for hazardous waste management.

In a letter of April 23, 1979, DLA gave interim guidance to primary-level field activities so they would be better prepared to comply with the new regulations when implemented. The new guidelines are expected to become effective in FY 80. Under this guidance, DFSC has initiated certain standards and controls to govern its own operations. DFSC actions include location of state-approved disposal sites near DFSC terminals for proper waste disposal, and institution of a manifest system to assure proper transport and arrival of wastes at approved disposal sites.

In addition to the actions mentioned above, attendance by DFSC personnel at a U.S. Army Environmental Hygiene Agency Workshop at Aberdeen, Maryland, is also planned. The workshop will not only cover the new federal regulations, but will also concentrate on state hazardous waste programs in the northeast portion of the United States. State representatives will be present to explain their program and answer questions. The workshop should be very beneficial since DFSC has several terminals in the Northeast.■

Hazardous Waste Tracking Document

No: ____________
Date: ____________

Facility Name: ____________
Address: ____________
____
Telephone: ____________

Type of Waste: ____________
Amount of Waste: ____________
Generator's Agent: ____________
(Print name and sign)
Transporter: ____________
Address: ____________
____
Telephone: ____________

Transporter's Agent: ____________
(Print name and sign)

Disposal Facility: ____________
Address: ____________
____
Telephone: ____________

Amount of Waste Received: ____________
Type of Waste Received: ____________
Disposal Facility Agent: ____________
(Print name and sign)

Date: ____________

(Forward to Generator within 30 days.)

Sample of DFSC transport manifest.

Gasohol Blending an Answer But Only for Some

International Petroleum Times

Shortfalls in motor spirit deliveries in Europe and Lengthening queues at US gas stations have refocused attention on alcohols as alternatives or supplements of motor spirit. Known in the US as gasohol alcohol-extended motor spirit is already on sale in the US and Brazil with a number of other countries keeping a close eye on developments.

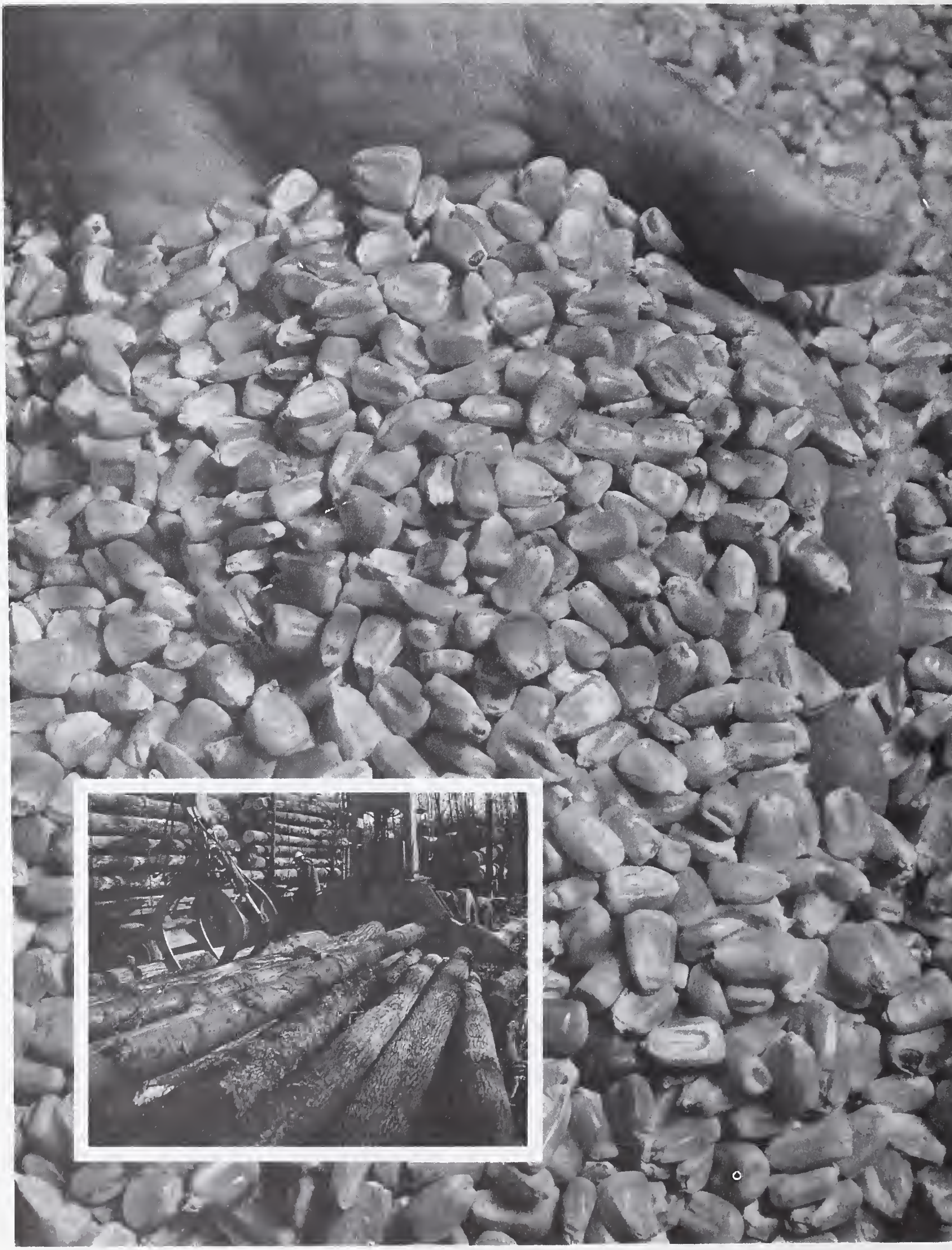
Interest in the alcohols, methanol and ethanol, as motor fuels first appeared after World War I. The problem at the time was agricultural surpluses, rising motor-car population and fears of an oil shortage. As fears of an oil shortage receded, interest waned. Alcohols did, however,find two uses as a motor fuel; in motor racing alcohols were widely used as fuels, their high octane value and their relative safety in the event of a fire (slow burning, low temperature flame) offsetting the high specific fuel consumption. The other use was a low percentage additive to motor spirit blends. The best known of these was Cleveland Discol which originally contained between 5 and 10 percent ethanol. By the time it was discontinued in 1976 it only contained 1 percent of isobutanol. The use of alcohol blend motor spirits in the inter-war years was mostly for marketing and product differentiation reasons rather than economic or technical ones.

The energy crisis of 1973/74 revived interest and triggered a great deal of research work, but easing supplies and declining real processes for motor spirit meant that practical interest waned.

The current position on alcohol utilization is that a limited number of countries are using gasohol blends usually to meet a specific situation. The biggest user is Brazil where it is currently claimed that 15 percent of the cars in the country are running on a gasohol containing 20 percent ethanol. The government's aim is to triple usage of this gasohol by 1982. The stimulus for Brazil is the balance of payments cost of imported oil and the large rural population growing sugar cane and faced with a declining world market for their sugar. The ethanol is produced by fermenting molasses with the bagasse (sugar cane waste) used to provide at least some of the energy required to distill the alcohol produced.

It has been estimated that alcohol produced this way costs nearly twice as much as motor spirit but in the context of the Brazilian economy the substitution makes sense.

A comparable situation occurs in the US where the National Energy Act passed by Congress effectively subsidises alcohol produced from agricultural surpluses. A gasohol containing 10 percent ethanol is currently available at over 500 petrol stations predominantly in the mid-West corn belt. The alcohol is produced by fermenting maize (corn). Other countries which are actively pursuing the



potential of gasohols are Thailand (ethanol from agricultural surpluses), Sudan (ethanol from molasses and sugar), various European countries (ethanol from farm surpluses and wine surpluses and methanol from coal), New Zealand (methanol from gas to avoid motor spirit imports), and South Africa (methanol from coal). In all these cases the fundamental economics are marginal or unattractive and the balance is titled by some special situation, usually balance of payments.

The principal advantage offered by both methanol and ethanol is that they offer a fuel supply directly within the control of consumer states. This consideration is likely to become increasingly important as OPEC crude prices rise and supplies becomes more constrained.

Both ethanol and methanol offer high octanes but low calorific values. Thus a great volume of alcohol (up to 40 percent more) is required to give the same power output as motor spirit. If, however, an engine is designed specifically to run on alcohol it can usefully use a higher compression ratio (up to 13:1) than a petrol engine.

The first major disadvantage of alcohols is that they do not mix with motor spirit and have a tendency to separate out. They take up water and this increases the phase separation tendency. The easier method to improve mixing is to add higher alcohols, the most economic being isopropanol or isobutanol. The problems being more severe with methanol than ethanol. The tendency to take up water would require considerable modifications to existing procedures for transportation and storage of motor spirt.

The second major disadvantage of alcohols is their tendency to leach out the plasticiser in plastic components (the same effect that caused plastic bottles for spirits to be withdrawn from the market). Modern cars use a number of such components in the fuel line/ carburettor system and these would need to be replaced by different plastics resistant to alcohol. The cost per car is relatively low but it does mean that oil companies are reluctant to incorporate alcohol into motor spirits except in countries such as Brazil where cars are produced with the appropriate components. There are a number of other problems with alcohols; poor starting properties (can be overcome by the addition of relatively expensive components such as iso-pentane), increased sensitivity, the difference between research octane number (RON) and motor octane number (MON) which gives some problems at sustained high speeds and corrosion problems with alloy components.

While none of these problems are insuperable recent trends in automotive design have made cars intolerant of alcohol blends. Older vehicles can easily be run on low level alcohol blends but the emission control and efficiency pressures have meant that current designs run on relatively lean mixtures and the addition of alcohol effectively makes the fuel leaner (lower calorific value of alcohols) alcohol-doped fuels give poor running and hence consumer resistance.

Because alcohols are single products rather than mixtures it is easier to arrange combustion that minimises the product of emission. Their lower combustion temperature minimises the production of nitrogen oxides, the most difficult pollutant to eliminate. For these reasons alcohols are widely referred to as cleaner or less polluting.

Both methanol and ethanol are more toxic than gasoline which would tend to rule out on-site blending on garage aprons (through blender pumps). It would also mean that all handling and distribution was subject to even stricter control than that for gasoline. Two years ago low prices of methanol induced the 'white pump' retailers of motor spirit in Germany to accept blends with up to 15 percent methanol. The starting problems and poor running that resulted have led European blenders to fight shy of alcohol blends at the moment.

The technical disadvantages are, outweighed, however, particularly in the minds of governments, by the advantage of broad-based production from secure sources. Ethanol can be fermented from a wide range of 'biomass' crops--sugar, bagasse, cassava, manioc, corn, cellulosic wastes, and lignocellulose. Methanol can be produced from wood, grain, natural gas, and coal. Current costs are way out of line with motor spirit but the situation is changing so fast that the alcohols could become attractive motor fuels within a decade.

Research work into alcohols as fuels has been undertaken by a wide variety of companies since the 1973/74 crisis. Perhaps the largest has been the $1.5 million project funded by the West German government. Volkswagen were the prime beneficiary of the funding and have carried out extensive tests on an 84 percent gasoline 15 percent methanol mixture. They found that starting/cold weather problems could be overcome using 90 percent methanol/10 percent higher alcohols in place of pure methanol. The German government is interested in the production of methanol from coal and some research has been devoted to examining the possibility of a pure methanol fuel. Current conclusions are that a 90 percent methanol/10 percent alcohol blend is a viable vehicle fuel.

Another line of approach investigated by the chemical companies BASF and Hoechst is to use a twin tanks system in which the vehicle is partially fuelled on gasoline and partly on methanol. BASF research also indicated that adding water (5 percent) to methanol reduced corrosion problems and lowered emissions. Apart from the potential for alcohol sales the chemical companies hope that the use of alcohol blends would reduce the demand for aromatics by the oil companies.

The enthusiasm for alcohol blends varies considerably across Europe but most of the major chemical companies have investigated the problem. Because of the higher cost of ethanol, attention has been focused on methanol.

The research has produced three broad conclusions: up to 8 percent methanol can be incorporated in existing fuels with minimal changes to existing systems. In this case the methanol is essentially used as a fuel extender. A more complicated fuel can be made using up to 20 percent

Over 200 million tons of trash are collected in the United States annually. Methods are being explored to recycle this trash for its energy content.

methanol but vehicles would have to be adjusted and distribution and handling procedures modified. Lastly, cars can be redesigned to run on almost pure methanol which would require major modifications to existing systems and the availability of large-scale methanol production facilities. As noted earlier, ethanol, except in special situations such as Brazil, is markedly less attractive but the same broad conclusions apply.

In oil industry terms methanol was seen as an easily handled product which could provide a cheap and effective method of turning natural gas in remote areas into a saleable product. The conversion efficiency of natural gas to methanol is only 60 percent, the process itself being energy intensive. The radical change in oil economics over the last few years has meant that gas liquefaction and ammonia production both look to be more effective routes for remote source natural gas than methanol production. At the present time chemical demand for methanol is tight and current expectation is that even the relatively large quantities due to appear on the market in the early 1980's will not lead to a significant surplus. The only practical route for methanol into gasoline is via methylterbutyl ether. MTBE is produced by reacting methanol with iso-butylene and has the property of being a good octane improver. So far it has been used in Germany to boost octanes in the face of reduced levels of lead additives. The biggest boost to its use has come with the clearance recently granted to it by the US Environmental Protection Agency (EPA). Faced with

increasing problems over supplies of non-lead gasoline the EPA has sanctioned the use of MTBE. Current estimates are that up to 7 percent MTBE will be added to gasoline to produce the required octane values and that production capacity will provide the only restraint to its adoption in the short term.

Although isobutylene availability rather than methanol availability is likely to constrain production, MTBE is likely to be a significant end use of methanol over the next decade. On the basis of current projection there is unlikely to be significant volumes of methanol available for direct blending into motor spirit before the late 1980's.

Assuming that major natural gas deposits are more likely to be pipelined or liquefied rather than converted to methanol, the only significant new source of methanol, is likely to be from coal.

Heinz Hiller of Lurge claims that on current costs coal conversion to methanol becomes attractive at an oil price of $23/bbl, a view which is confirmed by Uhde who claims methanol from lignite is now becoming commercially attractive. Uhde has proved up methanol from lignite in a pilot plant using the high-temperature Winkler process. Working in collaboration with Rheinische Braunkohlenwerke AG (Rheinbraun), Uhde has now started work on engineering a commercial scale plant. Ruhrkohle and Robrehemie have been studying the results from a 150 ton/day methanol-from-coal pilot plant using the Texaco process and consider the process should become commercially attractive by the mid-1980's. Another methanol from coal route is being investigated by Union Rheinische Braunkohlen Kraftstoff AG and Mobil Research and Development Corp. A pilot plant for the Mobil process is being built and should be on stream in 1981. Work with both Swedish and Brazilian companies aims to find an economical route to the production of methanol from wood using the HT Winkler process.

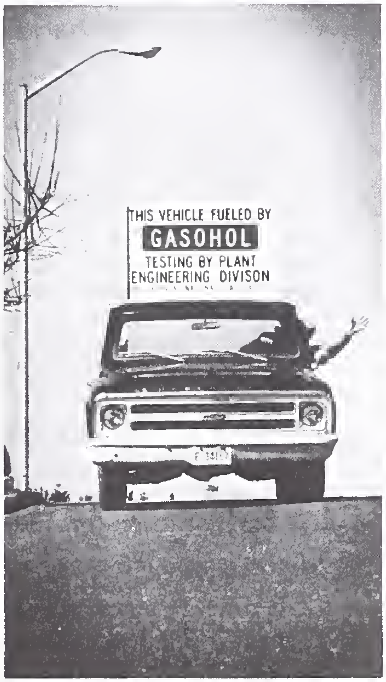
The future prospects for methanol can be divided into its uses as a chemical and its uses as a fuel. As a chemical its use seems assured with MTBE becoming an increasingly important end product. Synthesis from natural gas seems likely to remain the preferred synthesis route. The prospects for methanol as a fuel either as a motor fuel blendstock or as a turbine fuel will be determined by the cost and availability of crude oil. Only if a major move to synthesis from a low-grade energy source such as brown coal (lignite) occurs can major fuel use of methanol be anticipated in the near future. The basic economics of ethanol are currently so unattractive that only in special situations such as Brazil is it likely to be a significant fuel source. Only in the event of major and prolonged crude supply shortfalls would the position radically alter.

The use of dedicated fleets of vehicles run on alcohols is currently the most attractive possibility. Vehicle design could be optimised to make use of alcohol's special properties. The Brazilian post office already has a fleet of alcohol-powered vehicles operating in Sao Paulo and has plans for other dedicated fleets. Volkswagen has designs and limited production capacity for alcohol-powered vehicles, and

GM has also set up manufacturing facilities in Brazil for 'alcohol' engines.

In Europe the other possibility for dedicated vehicle fleets is liquefied petroleum gases, and the projected gas liquids production from the North Sea suggests this may be the more attractive route.

Whatever the immediate outcome, the pressure of rising crude costs and limited availability are likely to produce an increasing diversity of fuel sources for motor vehicles. ■



THIS GASOHOL-BURNING truck, part of the Brookhaven Lab fleet, is being used on routine runs to determine whether gasohol (a mixture of leaded gas and methyl alcohol) is feasible for all Brookhaven vehicles. Except for a tuneup, no modification was made to the truck for the test. The first tankful of gasohol was 15 percent alcohol. That may be increased to as much as 40 percent in experiments to determine peak efficiency. Earlier tests indicate gasohol burns cleaner than gasoline, may increase mileage, and in bulk purchase may cost slightly less than gasoline. (BNL Photo)

DoE Moves to Begin Designs of Commercial Oil Shale Facility

Department of Energy

The Department of Energy (DOE) is inviting prospective contractors to submit proposals for the design and potential construction of a commercial-scale surface module for extracting oil from shale.

The surface module would be used as part of a DOE effort to increase the nation's capability to produce commercial quantities of oil from its vast reserves of oil shale.

DOE anticipates awarding multiple contracts to design several types of oil shale "retorts," or heating vessels. Oil shale must be heated to at least 900 degrees to release the oil.

Up to 700 billion barrels of oil, many times greater than the proven reserves of Saudi Arabia, are thought to be recoverable from the high-grade oil shale deposits in Colorado, Wyoming and Utah.

These deposits contain 25 gallons or more of shale oil per ton of rock. Two tons of shale--about the volume of an office desk--would yield more than a barrel (42 gallons) of oil.

In April 1979, the President proposed a $3.00 per barrel oil shale production tax credit as a means to stimulate early commercial use of oil shale technology. The tax credit would begin to phase out when world oil prices reach $20 a barrel, and would be completely eliminated when prices reach $23 a barrel.

"The tax credit is still our preferred mechanism for stimulating oil shale production, since it permits a larger number of industrial participants and leaves the crucial business decisions in the hands of industry," said George Fumich, Jr., director of DOE's fossil energy program, which will administer the $15 million program.

"Should the tax credit not prove acceptable, however, the program we are beginning today will ensure that we have updated designs and can move forward quickly with actual cost-shared construction of the first module with little, if any, loss of time," Fumich said.

Although exact sizes will be determined by the initial designs, the first module could produce as much as 10,000 barrels of shale oil per day. Total cost of the initial facility, should construction be authorized, is estimated to be $150-200 million, depending on the exact size and complexity of the process chosen and assuming that an oil shale mine must be developed.

If an existing mine is used, construction costs would be in the range of $75-100 million. Full-size oil shale facilities would probably link several of these module together.

DOE is asking prospective contractors to share substantial portions of the costs of the projects. ■

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COVER

Samples of shale-oil petroleum products produced at Anvil Points, Colorado.

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